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June, 1936

"Let There Be Sight"

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The Sight-Saving Review

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Glaucoma

Philip A. Halper, M.D., F.A.C.S.

THE glaucoma patient who seeks the aid of an ophthalmologist early, carries out the doctor's advice faithfully, and remains under medical supervision permanently has a good chance of preserving his sight

THOSE who know the rôle which sight plays in the satisfaction derived from daily activity in social and creative life must look with fear upon any condition which can disastrously affect the vision.

Incidence

Glaucoma, that malignant disease so irreparably destructive to sight, especially when unrecognized, comes on either insidiously without warning or with symptoms so violent as sometimes to hide from consciousness its identity as a disease of the eye. In the United States there are over 100,000 blind persons and a far greater number who are partially sighted. Among the causes of blindness glaucoma takes a large toll, about ten per cent of all blindness being caused by this disease. It occurs at any age from infancy to senescence but is most frequent among adults.

Definition

Glaucoma is characterized by an increase in the intraocular pressure and results in the destruction of the retina by depriving it of its nutrition. It can be compared to destructive changes in the brain by persistent, increased intracranial pressure, or to violent symptoms and death in impaired kidney function. The disease results from an abnormal increase in the secretion of aqueous humor or, as is more commonly found, from an inadequate drainage of this fluid through the usual channels of exit.

Types

Glaucoma occurs in various forms. It may be either congenital or acquired. There are primary and secondary types; the former is found in a previously healthy eye, while the latter results from accompanying intraocular disease. In all its variations the end results when uncorrected are the same, namely, total blindness. The congenital type is present at birth and is due to an absence of the drainage structures. This leads directly to an abnormal accumulation of the aqueous fluid, resulting in an increase of the intraocular pressure. There also occurs an accompanying enlargement of the eyeball (ox-eye). Treatment consists in establishing new drainage channels.

The primary acquired type may be chronic, in which case the disease comes on insidiously, its destructive process acting so slowly and painlessly that vision may be lost long before one is aware of its presence, or it may be ushered in suddenly with acute symptoms, such as nausea, vomiting, or precordial pain, so violent as to throw one off the track of the underlying destructive process in the eye. Secondary glaucoma results from some other disease existing in the eye and is directly attributable to the underlying pathology, be it inflammation, injury, or tumor growth.

Intraocular Pressure

The pressure in the normal eye as measured with the tonometer is between 15 and 35 millimeters of mercury. In simple chronic glaucoma the tension may fluctuate between 35 and 50. Sight in such an eye is destroyed slowly by the continuous pressure comparable to the destruction of any vital structure by slow constant strangulation. Acute glaucoma, on the other hand, reduces the vision quickly, for the tension may rise as high as a hundred millimeters of mercury. Unless in the latter type the tension is relieved quickly—within several hours after the onset of glaucoma—the vision may be permanently lost, for the interruption of the retinal circulation results in the disintegration of the sensory cells of the retina. Vision in the retinal areas damaged by glaucoma is often beyond recovery.

Anatomy of the Eye

In order to understand the mechanism of glaucoma and the methods used to relieve the eye of this devastating disease, one needs to know the anatomy of the eye in relation to the aqueous fluid, for it is in the disturbance of the balance between the secretion and excretion of this fluid that glaucoma develops (Figure 1).

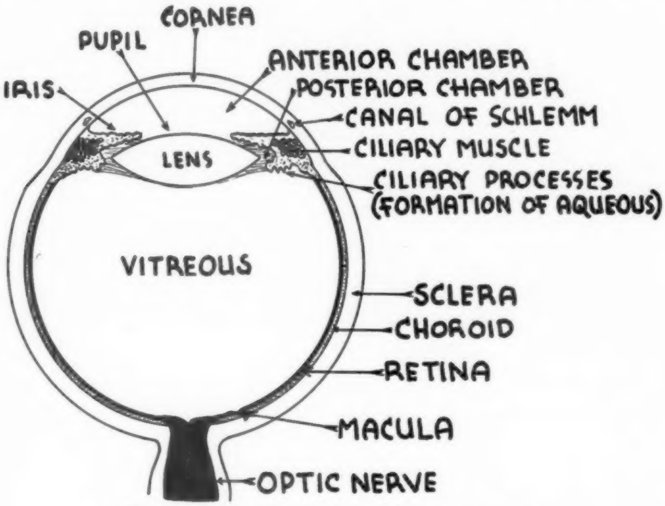

Figure 1.—Cross-section of the human eye

The outer coat (sclera), with its modified transparent structure in front (cornea), forms a tough support for the more delicate contents in the eyeball and protects these vital structures in much the same manner as the bony skull protects the brain and cranial nerves. Just within the sclera, and forming the middle coat, is the uveal tract (nutritional layer of the eyeball). The uveal tract is composed of: (1) the iris, (2) the ciliary body, divided into the ciliary processes, which secrete the aqueous fluid, and the ciliary muscle, which controls accommodation, and (3) the choroid, or the vascular structure. The innermost coat (retina) is the sensory part of the eye. It is a most delicate structure, and therefore the most vulnerable from the standpoint of disease or injury, and even slight damage results in disturbances in vision.

Since the retina possesses its own nutritional blood vessels, any interference with the retinal circulation influences sight, and this fact forms the basic cause of the loss of sight in glaucoma. The retinal vessels enter the eye with the optic nerve and extend to the outer part (periphery) of the retina (Figure 2). In the region of

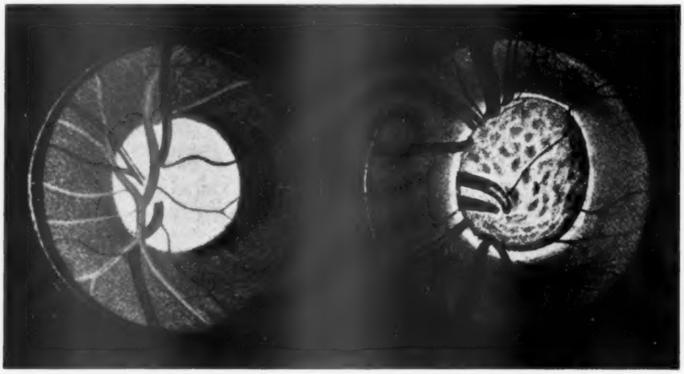

Figure 2 Figure 3

Figures 2 and 3 illustrate respectively what a doctor sees in a normal eye and a glaucomatous eye through an ophthalmoscope: 2 is a normal optic nerve head; 3 is a glaucomatous one

the optic nerve the vessels are largest, and as they extend outward the branches become smaller until in the most peripheral regions they are minute.

Within the eyeball is the vitreous body, a jelly-like substance held in place by a transparent network of tissue filaments. This structure supports the eyeball from within and prevents the eye from collapsing. Pressure exerted on the vitreous from the front of the eyeball by an accumulating aqueous fluid, which in glaucoma has deficient avenues of drainage, is transmitted in all directions and this pressure on the retina results in interference with the retinal circulation. This in turn affects the nutrition of the retina and loss of vision follows.

Physiology of Aqueous

The aqueous fluid, like all other secretions of the body, is constantly being formed and eliminated. This fluid, which brings

nourishment to the lens and surrounding structures, arises in the ciliary processes, then passes through the pupil into the anterior chamber and is largely eliminated from the eye through the canals of Schlemm at the corneoscleral junction (Figure 4). In this

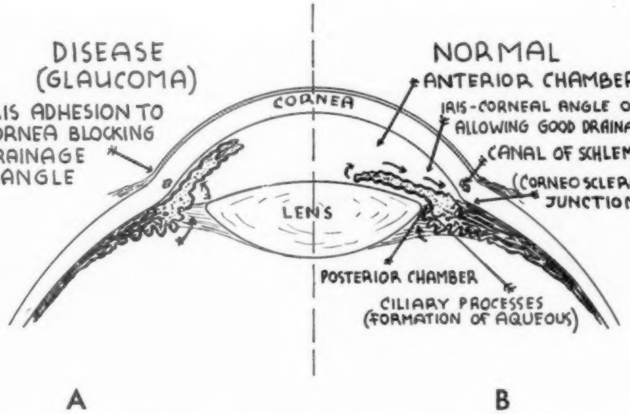

Figure 4.—Cross-section of eye, comparing glaucomatous with healthy eye: "A", glaucomatous, "B", normal. Arrows show direction of aqueous flow

region are found large veins in close relation to the canals of Schlemm and the aqueous finds its way into these venous channels. The aqueous is therefore eliminated largely through the venous circulation in the anterior part of the eyeball. The cycle of the aqueous is therefore as follows: formation in the ciliary processes, outflow through the pupil into the anterior chamber, and exit from the eye through Schlemm's canals. A small portion of the aqueous is reabsorbed into the ciliary body and iris.

Physiology of Retina

In the human eye are found two types of vision—central and peripheral (Figure 5). The former obtains in looking at an object directly, the sensory impression of the object falling upon a very small part of the retina, namely, the macula. This area is the most highly developed area in the eye. Peripheral or indirect vision is obtained when the retina outside the macular area is stimulated.

In looking at an object directly one sees indistinctly many objects above, below, and to the sides. This indirect or peripheral vision is of inestimable value in our daily activities and its impairment can readily be appreciated while driving an automobile, while working, dining with several people, or even walking.

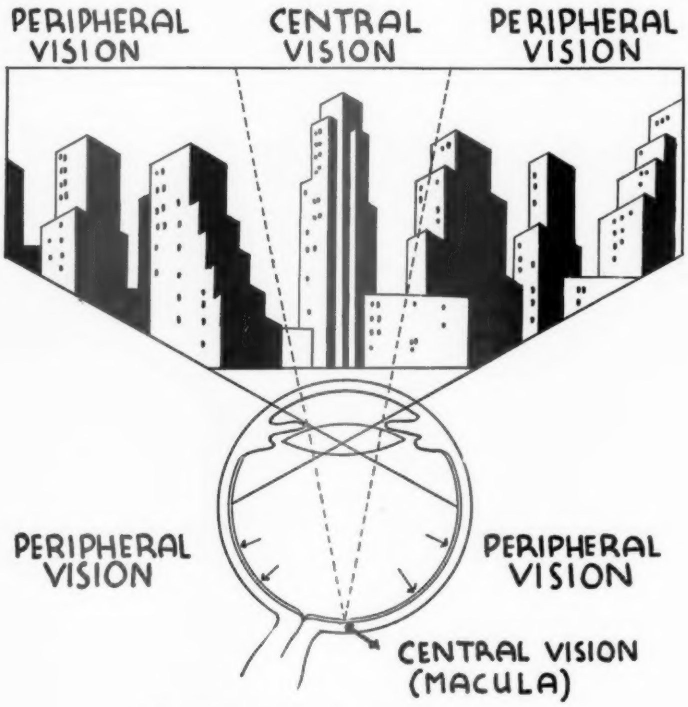

Figure 5.—What the normal eye sees

Pathology of Retina

The retina depends for its nourishment on its own circulation, and the large retinal vessels make their appearance in the eyeball with the optic nerve (Figure 2). From here they branch out and spread peripherally so that the terminal branches at the extreme periphery of the retina are the tiniest. The main trunk and branches of the retinal vessels may well be compared to a river with

its tributaries. In a very dry season the smallest streams dry up, and the soil nurtured by these streams becomes arid and barren. The larger tributaries and main channel become smaller and shallower and should the countryside be an agricultural one, poor crops and destitution follow. As the drainage of aqueous is inter-

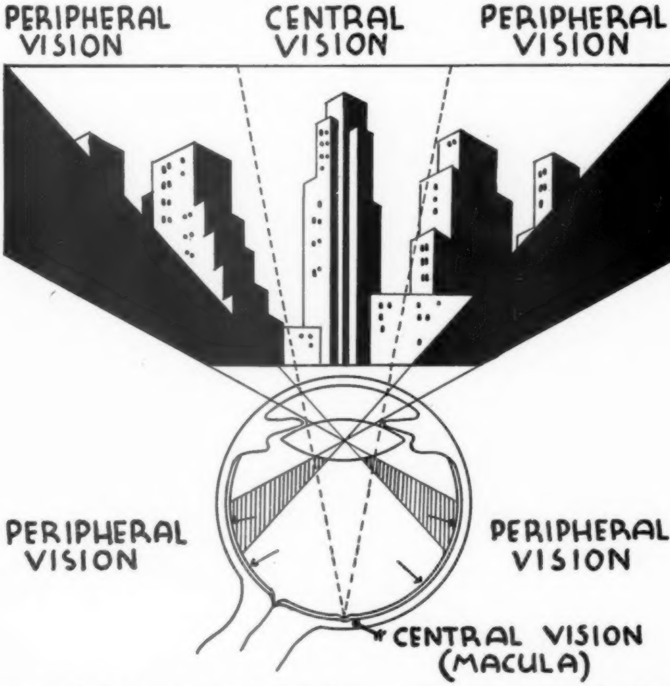

Figure 6.—Early glaucoma. Arrows show pressure on retina resulting in reduction of peripheral vision

fered with, this fluid increases in amount and exerts its pressure in all directions. Since the outer coat of the eye (sclera and cornea) is very resistant, the increased intraocular pressure soon destroys the smallest retinal vessels at the periphery and the retina in that area undergoes atrophy. Eventually the optic nerve atrophies and is pushed backward, producing the typical glaucomatous cupping (Figure 3). In glaucoma, therefore, the retina is damaged from the periphery inward toward the macula, and the peripheral

field of vision contracts (Figure 6). As the process of destruction continues, the peripheral field shrinks more and more (Figure 7) and finally disappears altogether. In such an eye the central vision alone remains (Figure 8) and this confines the visual capacity in much the same manner as obtains in looking through a tube. This limited vision is therefore called tubular vision.

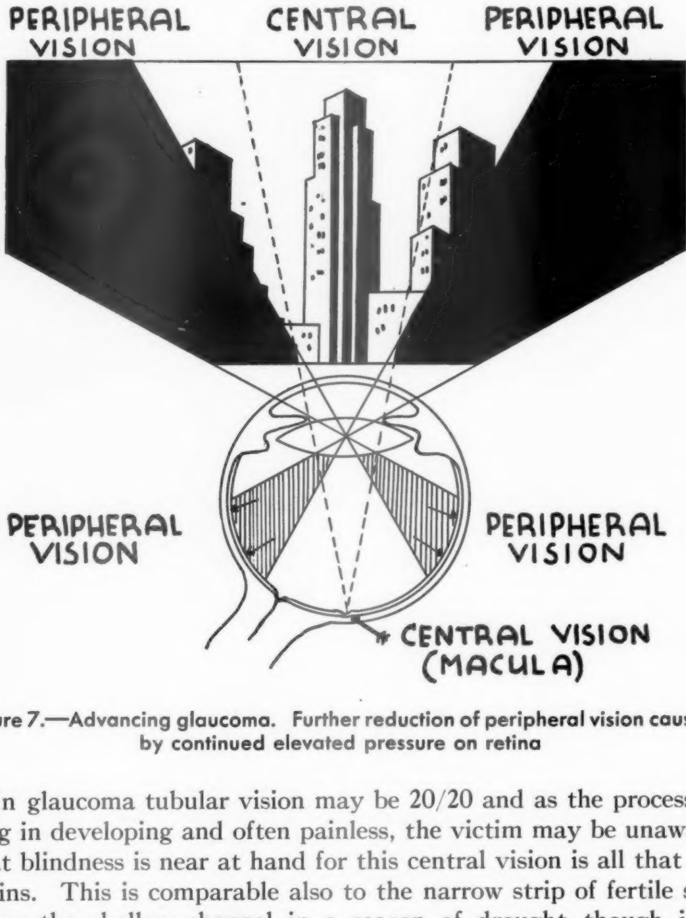

Figure 7.—Advancing glaucoma. Further reduction of peripheral vision caused by continued elevated pressure on retina

In glaucoma tubular vision may be 20/20 and as the process is long in developing and often painless, the victim may be unaware that blindness is near at hand for this central vision is all that remains. This is comparable also to the narrow strip of fertile soil along the shallow channel in a season of drought, though just

beyond the narrow fertile strip the soil is parched and unproductive, unable to maintain any plant or animal life. As the heat of the sun continues and no rain falls, there results a complete drying up of even the main channel and the river banks, too, take on the destitution of the surrounding country. In the eye, when the high

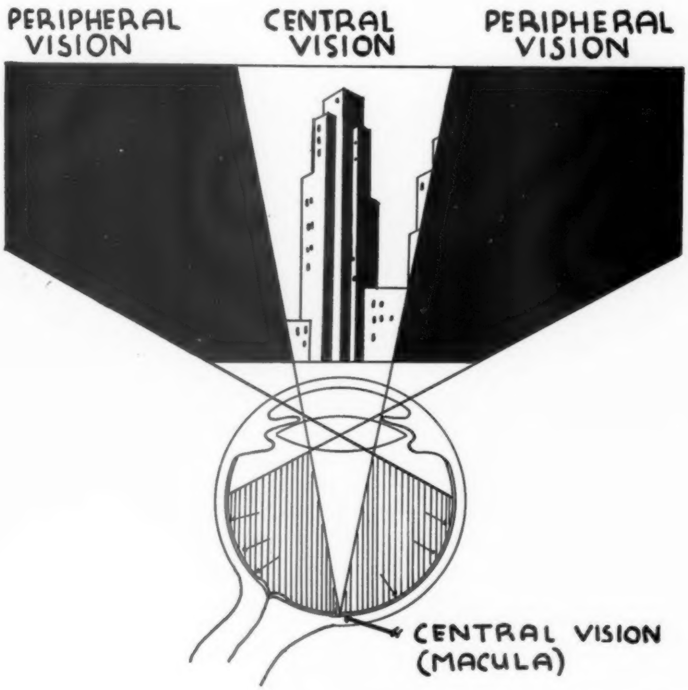

Figure 8.—Advanced glaucoma—tubular (central) vision. Peripheral fields of vision entirely destroyed

pressure continues unchanged, the main retinal vessels also are unable to withstand the increased pressure and the central vision is finally lost (Figure 9). When this last situation overtakes one, he is thrust into the darkness of night, never again to find his way back to light, for when central vision goes, the sight is irretrievably gone—an overwhelming price to pay for neglect and indifference.

Absolute glaucoma exists when sight is entirely gone and when the eyeball is of stony hardness.

Symptoms

Unfortunately, the person with the simple type of glaucoma showing the tragic picture above is often without physical dis-

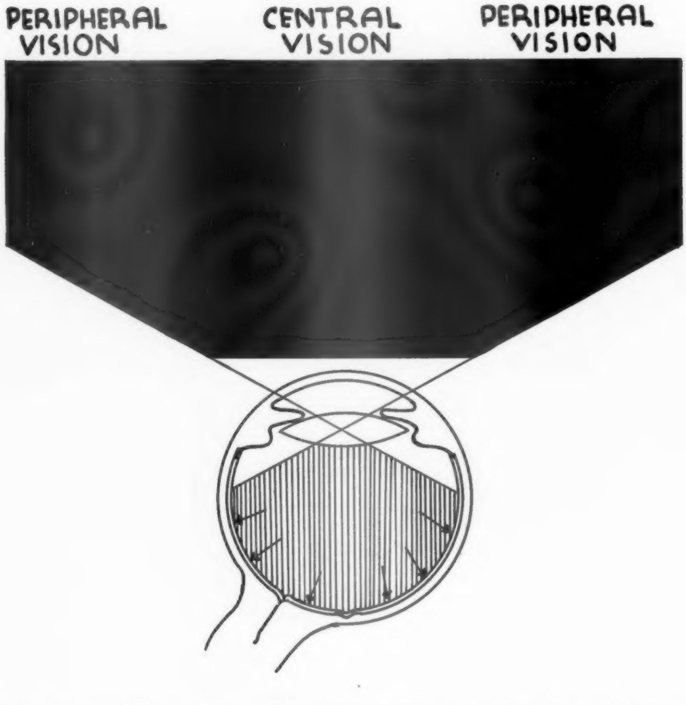

Figure 9.—Blindness—both peripheral and central fields of vision destroyed

comfort and gradual loss of vision may be the only complaint. There may be headaches, pain in and about the eyes, and halos around lights. The acute type of glaucoma may be ushered in with violent symptoms, such as nausea, vomiting, discomfort about the heart, and extreme pain in the eyes.

Treatment

Since the disease is due to an increase in the intraocular pressure, the treatment and cure lie in permanently relieving this pressure. This is done medically by instilling drugs into the eye which contract the pupil and free the drainage angle by pulling the root of the iris away from the cornea (Figure 4). Should the tension fall within normal limits with the instillation of drops and the field remain stationary, the disease may be considered checked, but in that case it is necessary to use drops in the eye daily thereafter. When the drugs do not succeed in lowering the pressure or when the pressure is lowered and visual field studies continue to show progressive contraction of the peripheral field, surgery must be resorted to. The extent of contractions of the peripheral fields, together with the duration of the disease, determines the type of operation to be performed. Since these eyes show adhesions between the iris root and cornea, thereby permanently blocking the drainage angle (Figure 4), new avenues of exit must be established for the outflow of the aqueous. In the large majority of cases, surgery succeeds in lowering the intraocular pressure by diverting the drainage of aqueous fluid into new venous channels in a way which remains permanently adequate. The disease is then said to be cured and no further damage to vision is expected. However, the visual loss which one suffered up to that time usually remains. The urgent need, therefore, in this condition is early recognition and adequate treatment.

Summary

Glaucoma is a disease of the eye, common in its occurrence and destructive in its behavior. It lends itself quite early to diagnosis and consequently to cure. One should always be aware of its presence: headaches, halos about the lights, pain in the eyes, and diminishing vision (particularly side vision) should make one suspicious of its presence. It must be attacked with understanding and vigor, for its malignant nature leaves hopeless destruction in its wake. The glaucoma patient who seeks the aid of an ophthalmologist early, carries out the doctor's advice faithfully, and remains under medical supervision permanently has a good chance of preserving his sight.

Eye Conditions Prevalent in Preschool Age*

Charles A. Hargitt, M.D.

MALNUTRITION and unhygienic environment in childhood are conducive to the susceptibility of the eye to certain diseases

IT is, of course, true of eye diseases, as it is of general diseases, that the individual child who is the victim of unhygienic surroundings and malnutrition, which may mean either insufficient nourishment, or improperly balanced nourishment, or both, is destined to be more susceptible to disease or to maldevelopment which may seriously handicap it for life than is the child in healthy surroundings.

A not uncommon condition that we find among the children, that to some extent must be associated with unhygienic living, is one called ulcerative blepharitis. This is readily recognized by the thickened lid margins, and the yellowish scales or scabs among the lashes. Some of these cases among the older children are probably associated with eyestrain and the need of glasses. If this condition is not promptly recognized and treated, it becomes chronic, resulting in permanently thickened lids, with edges more or less everted, and with scanty lashes. This means imperfect protection to the eyeball, making it easier for the eye to become traumatized, and this may result in serious impairment of vision.

Sties you are all familiar with. These are infections in the lash follicles and often form sizable abscesses. When there are frequent recurrences of them, it means a lowered general resistance to infection and probably unbalanced diet.

* Presented at the Institute on Conservation of Vision, Brooklyn, N. Y., April 16, 1936; arranged by the Bureau of Prevention of Blindness of the Division of the Blind, New York State Department of Social Welfare; and sponsored by the Eyesight Conservation Committee of the Brooklyn Health Council; Medical Society, County of Kings and Academy of Medicine; and the Brooklyn Ophthalmological Society.

The acute infections of the conjunctiva are fairly common. In general, these have no direct bearing upon the problem of diet. They do have a very definite relationship with home hygiene as they are easily spread by contact. Fortunately most of these infections are largely self-limited and result in no permanent disability. If they are recognized early and treatment instituted they usually respond very promptly. The gonococcal infections are, of course, potentially much more dangerous. These are becoming, relatively, quite rare. The typical case can, with fair certainty, be diagnosed by inspection alone. The upper lid is red, swollen and drooping, so that the globe is entirely covered. There is a thick yellow creamy pus showing between the lid margins. With prompt recognition and treatment, serious complications are the exception. Early neglect, however, may well result in destructive ulceration of the cornea, ending in serious or total loss of vision.

The diphtheritic infections of the conjunctiva have become very rare. I do not recall having seen such a case in the past ten years or more. This, of course, is directly attributable to the almost complete control of this disease that has been attained in the past few years.

Of the affections of the cornea which properly come into the general problem under discussion, perhaps the most common is the so-called eczematous or scrofulous keratitis. This again in its typical manifestation can almost surely be diagnosed by inspection alone, without touching the child. Both eyes are usually involved. The child will keep the eyes nearly closed because of the extreme photophobia, or painful sensitiveness to light. The skin at the outer angles of the lids is usually macerated. On the slightest attempt to open the eyes there is profuse tearing. The conjunctiva is red, and on the cornea will be one or more small grey spots which, in the course of the disease, usually develop eroded surfaces. If the attack is prolonged, or if there are recurrences, more or less scarring with permanent reduction of vision, is inevitable. This disease occurs often in children in whom there are evidences of tuberculosis in some form or, at least, where there is a tubercular heritage. That improper diet may be a factor is evidenced by the fact that if these children are hospitalized, where a better balanced

diet is the rule, they respond very quickly to very simple local treatment, only to suffer recurrences upon being returned to their homes. Probably a large proportion of these cases is seen among the negro children, and the incidence of tuberculosis is comparatively high in that race.

Another affection of the cornea which is definitely linked to the nutritional or dietary problem is the phlyctenular disease. This does not need much more than mention, as it is rarely serious in its threat to vision. It is characterized by small round yellowish elevations which usually appear at the junction of the cornea with the conjunctiva, and accompanied by a more or less acute inflammation localized in that region of the eye. Its relationship with the dietary problem lies in the fact that it is frequently associated with an overindulgence in carbohydrates. There is evidence that in some cases it is caused by the action of the toxins from some active tubercular process elsewhere in the body.

The most severe forms of corneal disease associated with malnutrition, fortunately, are rarely seen in this country. I refer to the disease which we call keratomalacia, which means softening of cornea. It is prevalent in China. In this disease, the whole cornea may be destroyed.

One other disease of the cornea which we still see too frequently among the preschool age children, as well as in the older children, is interstitial keratitis. This is not a nutritional problem, but a hygienic one, and bulks large in the great problem of conservation of vision. It is almost always caused by inherited syphilis, and many times it will be the first recognized sign of that disease. In the well advanced stage, the cornea loses a considerable degree of its transparency, the eye is acutely inflamed, and there is a considerable degree of photophobia. The early recognition of it and the prompt institution of treatment will, in many cases, result in a shortening of the attack and a more or less perfect restoration of the transparency of the cornea. Another very important need for its prompt recognition lies in the fact that inasmuch as this may be the first evidence of syphilis in the child, early and vigorous treatment may not only prevent serious loss of vision, but may prevent other serious developments elsewhere in the body, particularly in the nervous system.

In discussing the hereditary conditions that are seen in the young patient, I shall confine myself to infantile glaucoma and congenital cataract. In the former, the first symptom or manifestation of it, if it is not already well advanced at birth, is in the gradual but eventual marked enlargement of the globe, as compared to the other eye (it is usually confined to one eye). Then there becomes evident a bluish or slate-colored hue to the white of the eye, because the black pigment layer shows through the thinned white scleral coat. In the later stages, the cornea becomes irregularly bulging and opaque. This deforming of the eyeball is due to the fluid over-distention of the globe before the supporting walls are well developed and strong enough to withstand the tension. It is probably caused by an anomalous anatomical development which prevents the normal drainage of the intraocular fluids which are constantly being formed.

Infantile glaucoma is distinctly different in many respects from the glaucoma of adult life. They are alike in the sense that total loss of vision is the inevitable result, if not controlled. Early recognition of the infantile glaucoma is vital for two reasons. If the eye is not already blind, suitable treatment may save some sight. Even if the eye be blind, if the extreme malformation has not progressed too far, proper treatment may prevent the later necessity of removing the eye for cosmetic reasons.

Congenital cataract is another condition which has an important place in our general problem of conservation of vision. Cataract, as most of you probably know, is a disease of the lens of the eye, in which the normal transparency gives way to a developing opaqueness. Congenital cataracts are probably mostly due to some imperfect development of the eye during fetal life, which arrests the full development of the lens, or deprives it of its normal nourishment. Some of these cases are fully formed at time of birth and are recognized by the appearance of the pupil, which looks milky white instead of the usual, apparent black. Some cases of partial cataract can be easily overlooked on casual observation. The kind of treatment, if any, which is indicated in these cases depends upon the type of cataract and the degree of opaqueness present. Early removal of the fully developed cataract is

necessary if we are to prevent a permanent arrest of a useful visual sense.

Eye affections in young children resulting from focal infections are not as common as in adults. When they do occur, they are more likely to start in the posterior portions of the eye and hence may be entirely unobserved during the early or active stage. This can be so, because of absence of pain, and because the anterior half of the eye may be entirely free from any redness or inflammation. Furthermore, any disturbance of vision, particularly if limited to one eye, would probably not be noticed by the child, hence is not reported. We do, however, occasionally meet with some tragic cases in which, during some of the acute illnesses more or less common to children, an infection is carried in the blood stream to be lodged in the posterior part of the vascular coat, or in the retina of one or both eyes, there developing as an abscess, and at times resulting in total blindness.

There is another class of disease which affects young children as well as adults and may result in serious loss of vision. I refer to choroiditis, a disease of the choroid layer, and usually involving the overlying retina as well. The two most frequent causes are tuberculosis and syphilis. Many times, cases of choroiditis are not seen during the early development, as there are no external signs. It can be detected only by examination of the interior of the eye. This fact illustrates the importance of thorough examination of children's eyes at reasonable intervals, even in the absence of signs or symptoms of trouble.

There is another class of affection quite common in young children, which plays a very important part in our general problem. I refer to the cases of strabismus or squint. The most common form is the converging squint, commonly spoken of as cross-eye. These cases are usually noticed early, because of the very obvious appearance, but there are still too many parents who persist in the belief that their child will outgrow it, and nothing need be done. The more common causes of this condition are either a definite malformation in one or more of the rotating muscles of the eye, preventing a full and free rotation of the globes; a high degree of hyperopia or "farsightedness"; or an imperfect development of the fusion sense. It would require too much time to enter

into a technical explanation of these. What I do wish to emphasize is that all of these cases should be submitted for adequate examination at the first definite appearance of the squint. Many of these cases can be controlled and, in time, cured by the fitting of proper glasses when indicated, even in the very young child of two or three years of age. When this fails to accomplish the desired result, the surgical correction of the squint should not be too long delayed. The importance of this is due to the fact that our experience has taught us that a squinting eye which has remained uncorrected for an appreciable length of time may be found subsequently to have very imperfect vision; whereas after early surgical correction, followed in some cases by carefully supervised muscle training, useful or normal vision in the squinting eye may result. Many parents object to the use of glasses in small children because of their fear of injury to the eyes from accidental breaking of the lenses. The danger of this is very slight.

In considering the problem of eye injuries, I shall again speak in more or less general terms. Any form of traumatism to the eye may have serious results, in terms of vision. This can be true of seemingly trivial abrasions of the cornea, which usually heal very quickly without any impairment of function. Or a simple foreign body, embedded in the corneal surface, may through infection or delay in removal, result in ulcer formation with resultant scarring. If this takes place in the pupil area of the cornea, serious impairment of vision may result.

Any injury which causes a laceration and particularly penetration of the eyeball is always dangerous. If the lens of the eye is involved, it will almost certainly become cataractous. Or if the cornea alone is involved, there may be resulting scar formation which may result in impaired vision. Sharp pointed toys are always dangerous for children.

There is one type of injury that always involves the oculist as well as the parents or guardians in grave responsibility. I refer to the type of injuries which experience has taught us may result in sympathetic involvement of the fellow eye. It is bad enough for one eye to be seriously damaged or lost, but it is tragedy indeed when the second eye is involved in threatening inflammation which may destroy its vision also. The hardest decision that

a parent may be called upon to make, in this matter, is to consent to the removal of an injured eye in which there is still considerable vision, but this is very necessary at times. Sympathetic involvement in the second eye may not threaten until several years after the injury, but when it starts, it is then oftentimes too late to save it, even if then the injured eye be removed.

Accidents in Traffic and Industry as Related to the Psychology of Vision*

T. W. Forbes, Ph.D.

THE author discusses the factors involved in visual judgments of speed and distance, as well as in fatigue and drowsiness—factors which determine the efficiency of the driver or the industrial worker

MANY of the accidents on the highway and in industry eliminate vision completely and permanently, sometimes by eliminating the individual. Figures of the Travelers Life Insurance Company show that in the United States four per cent of the people involved in highway accidents are killed and some 18.5 per cent of the non-fatal accidents are of the type which may also involve injury to the eyes, namely, skull and brain injuries and injuries involving contusions and lacerations. The proportion of traffic accidents from psychological causes has been placed as high as 80 per cent.

In applying the psychology of vision to accidents, we are interested in the way people use their eyes, how that affects liability to accident and what remedies may be applied. In so doing we will consider both average vision and non-average vision. Pathological conditions are, of course, a medical problem. They will be discussed in this paper as briefly as possible and only as they affect behavior. There are, however, many phases of vision and wide differences in vision in medically normal eyes which affect the behavior of drivers and of industrial workers.

*Presented at the Institute on Conservation of Vision, Brooklyn, N. Y., April 16, 1936; arranged by the Bureau of Prevention of Blindness of the Division of the Blind, New York State Department of Social Welfare; and sponsored by the Eyesight Conservation Committee of the Brooklyn Health Council; Medical Society, County of Kings, and Academy of Medicine; and the Brooklyn Ophthalmological Society.

The psychological factors in vision which will be discussed are those affecting reaction time and judgments. They are the extent of the field of vision, the introduction of movements of the head for visual purposes, visual attention, the acuity of vision as it affects the psychological reaction, color-blindness, visual factors in judgment of speed and distance, susceptibility to glare, the time for adjustment or fixation of the eyes, a person's reaction time to visual impression at the periphery of the eye as against those of the fovea or center, and finally fatigue and drowsiness of the individual from visual factors. The relation of the psychology of vision to traffic accidents will receive most attention, since the speaker has been most closely related with that field.

Field of Vision

The occurrence of a narrowed field of vision in extreme cases (so-called "tunnel vision") is a source of auto accidents. The following is an extreme case:

An employee of a company which operates a fleet of cars was referred to our psychological accident clinic because of the fact that he had had several serious accidents with company cars in and about the garage. One of these was apparently almost unexplainable. He had taken a light truck to which he had been assigned and had backed it rapidly out through the garage door, squarely into the private car of one of the executives. This, of course, gained him immediate personal attention. There seemed to be absolutely no excuse for his having done this sort of thing although he claimed that he had not noticed that the car was there. He was a middle-aged man, apparently in good health, and had passed the ordinary medical examination. Upon examination he showed competence in automotive manipulation, and in all other respects until it was discovered that he had a well-defined case of "tunnel vision." In other words, he was unable to see with any degree of clearness any object more than about 10 degrees to either side of a line straight ahead of him. Here, obviously, was a man who should have been excluded from driving. We were dealing with a definitely unusual eye condition which would have been detected by a complete ophthalmological examination.

Strangely enough, however, this man had been driving a personal car for some years and, as far as we could learn, had never had a serious accident. The question then arises as to how he was able to drive privately and not commercially. The answer turned

out to be a matter of family organization. We discovered that when driving his personal car he had an agreement with his wife to cover all parts of the visual field for him except the 20 degree angle straight ahead. She therefore kept watch and took the place of the vision from the periphery of the eye which he lacked. With care, this arrangement had apparently been successful. When, however, he had been forced by his job to drive alone, he immediately figured consistently in accidents.

This case, therefore, illustrates the fact not only that a wide field of vision is very necessary for safe driving but it also illustrates the fact that a great number of people are undoubtedly driving with most unfavorable visual conditions.

The question now arises, "What factors make a wide visual field or angle of vision of crucial importance?" The function of the periphery of the retina seems to be to cause a reflex turning of the head in the direction of the objects seen. This allows focusing of the central part of the retina, with its greater acuity, on the object. It has long been known that there is a greater sensitivity for the seeing of moving objects in the edge of the visual field. It has been shown, however, that when a person is asked to respond as quickly as possible with his hand after seeing an object he responds quicker when the object is in the center of the field than he does when it is out on the edge. The reflex turning of the head and eyes, however, is much faster than the fastest eye-hand reaction to an object in the center of the field. It is thus evident that reflex turning can take place before a person can respond with brakes, clutch or horn, when an object comes into the side of the field.

It has also been shown by actual experimental study that the best drivers do not rely on "seeing out of the corner of the eye" but do actually turn their heads continuously and rapidly back and forth. They therefore bring into clear focus a very wide area in front of them. It is thus possible for a person to overcome, to some extent at least, the handicap of a slight narrowing of his field of vision.

For practical purposes, then, we are faced with the question: At what point shall narrowness of field vision be considered unsafe for auto driving and for other similar tasks in industry where moving vehicles, trains or other devices are being controlled?

This is a question which must be answered before tests of field of vision can be used for selection purposes. The answer can be obtained by the testing of individuals with psychological test apparatus, simulating as nearly as possible the conditions to be met on the road or on the job. Psychological tests of this sort have been in the process of development for some years, first at Ohio State University and more recently at Iowa State College and Harvard University.

Visual Attention

Visual attention is a psychological factor which must be reckoned with since it is quite possible for a person with perfect eyesight to be effectively blind, due to concentration of his attention on some one part of the visual field. The study above referred to showed that some accident prone auto drivers tended to make less head movements than the better drivers and observation showed that often this was due to watching some pretty girl on the side of the street, intently. Such intent visual focus can be shown in the laboratory to produce effective blindness for everything else in the visual field, that is, a person will not be able to report other objects which he would otherwise undoubtedly see. In safety education campaigns, therefore, people should be advised to move their gaze over the various parts of the field continuously in order to guard against such concentrated attention.

Myopia

Uncorrected nearsightedness of the less severe sort probably affects the behavior of the driver mostly in connection with the reading of signs. He must slow down or stop and thus impede traffic. He may also get into the wrong lane for a turn because he is unable to read a sign, and then at the last minute jerk his car across in front of traffic causing at worst, a bad smash, or at best the screeching of brakes and exercise of the well-known automobile temper and vocabulary.

Color Vision

Color blindness is a factor which has been taken into account by the traffic engineers but which is still a factor in traffic control and

accidents. The most common type of color blindness is, of course, the inability to see red and green, and the less common one is the inability to see blue and yellow. Inclusion of yellow in the red traffic signal and blue in the green signal has been designed to aid the red-green blind people in seeing traffic signals and is a distinct advance. However, to the color-blind driver, one of the predominant characteristics of a colored light is its brightness value. That is, instead of seeing red and green he sees a dark and a light gray. The difference in these lights becomes less as the intensity of both lights becomes weaker, that is when the light is quite a distance away. The more severely color-blind person may therefore be able to tell the difference between the red and green close at hand but may not be able to distinguish them at three or four blocks distance when the lights are spaced as they are in Manhattan, for instance. The recommendation which has been made by the traffic engineers, that the red light be always kept in the same relative position, helps this situation materially and should be made universal.

A second color vision factor which applies not only to the color blind but to the normal individual is the question of differentiating signal lights from surrounding lights. This difficulty becomes quite obvious if one is driving down a city street with lighted store windows on both sides and looking three or four blocks ahead to a light situated among a cluster of red Neon signs. It may be practically impossible to tell whether there is a red signal showing or not. Laboratory tests have shown that reaction time is very much slower to a visual signal when the visual signal is being discriminated from other ones which are very similar to it. Thus the situation mentioned is the poorest possible one for producing a quick response in the driver, even if the driver is concentrating and trying to respond quickly.

In industry the situation can be fairly easily overcome, since surrounding lights can be controlled and their color chosen to be quite different from signal lights. In city traffic, however, the solution is less easy to prescribe. A semaphore type of signal light, somewhat similar to those used in certain railroad block signals, might be one solution but would probably be prohibitive in cost. A better solution might be to require all store signs and lights to

be shielded from the side so as not to be visible to the driver who is over a block away.

Color Contrast and Legibility of Road Signs

Color contrast has been extensively investigated in connection with advertising signs and also to some extent in connection with road signs. Black on white and black on yellow give the best legibility. Also simple diagrammatic signs are read more quickly than ones containing verbal material. This has been shown most effectively by presenting different types of material in a quick exposure device known as the tachistoscope and measuring the actual time of exposure necessary for reading.

As suggested in connection with nearsightedness, road signs and possibly advertising signs may be causes of accidents in as far as they distract visual attention from the road.

Visual Judgment of Distance and Speed

Another very important psychological response which is definitely dependent on vision is the recognition of objects, the judgment of their distance away and their speed and direction. This is obviously important in driving and also enters in certain industrial jobs and processes. For instance, a person may round a corner or curve at fair speed and come upon a truck. He must know in a fraction of a second whether the truck is moving ahead at 40 miles an hour, at 10 or 15 miles an hour, stopped, or actually backing up.

Such recognition and judgment in daylight depend on the visual impression of changing shape and size of the object or vehicle, changing shadows, the visual disparity or difference in the pictures obtained by the two eyes, and seeing the object or vehicle pass other objects. The judging of objects closer than 20 feet, which is necessary in some industrial tasks, also depends on the reflex responses of the pupils of the eye and on convergence. The one-eyed individual is at a distinct disadvantage because of the lack of the binocular effect and therefore cannot judge distance and speed as accurately and as easily as the normal individual.

In poor illumination such judgments are hampered by the loss

of distinct outlines of shape and size and the loss of the effect from shadows. Through a long process of learning to judge visual distance under normal conditions, the object is judged as being far away and larger than it actually is when it is dim. From this comes the well known and startling effect of vehicles looming up out of the fog or mist, apparently very suddenly. They appear to be at quite a distance until very close when one suddenly realizes their nearness. Veterans on the sea and railroads know this fact and are suspicious of their judgments under these conditions. The ordinary auto driver, however, is likely not to be familiar with this effect and to be fooled by it.

Visual judgments of speed are at best uncertain as shown by the fact that even in good light visual cues may be overcome by an erroneous idea or expectancy of speed or distance. This is the sort of thing that occurs when one drives up on the open road behind a bus or truck which is moving very slowly, but which was thought to be moving faster. One often finds it necessary to use brakes in such a situation when he did not expect to. In some experimental work of my own some years ago, individuals were asked to judge the point at which an oncoming car would be met and, again and again, serious misjudgments occurred. For instance, a car which was being driven rapidly was judged as going slowly because as the person being tested said later he "thought that it probably would be going slow." Errors as great as 50 yards were made and the most frequent error was 8 to 10 yards. A study from Germany reports similar results. These results emphasize the hazard of stopping one's own car dead or backing where other drivers or operators of other moving objects or devices do not expect such a stop. Accidents from putting on brakes too suddenly at intersections fall in this class also.

The operator whose ability to make visual judgments of distance is poor, of course, runs the most chance of accident under the circumstances just mentioned. One of the most hair-raising afternoons I have ever spent was with such a driver. He was driving me some distance and I made the error of discussing judgments of speed and distance. His driving had been fair except that in a too frequent number of cases an oncoming car had caught us just about to pass and brakes had to be slammed on to prevent hitting the

car ahead of us. It was apparent that his judgment of visual distance was not of the best.

Upon my remark that the tests showed that most people do not make judgments of visual speed with any too much accuracy, however, he undertook to show me that he at least, could. From then on I regretted the remark. We would hurtle up behind a car and continue our speed long after it was apparent that there was not room to pass. The driver still thought he could get by, but about the time a crash looked inevitable he would discover his error and slam on the brakes. If one of the cars ahead had changed speed or the tires had struck a smooth spot there would certainly have been an accident. May I emphasize—this was not intentional recklessness. And in the end the driver was still unconvinced.

One of the advantages of the psychological testing method is that you can show a man how he stacks up against others in visual judgments, and do it without risking your own life. In general, these studies indicate that the average person should expect to make a very considerable error in visual judgments of speed on the open road. The average driver should be educated not to pass if the margin is at all close and he desires to enjoy his next meal.

At night, judgments must be made on a very much reduced visual basis. Only the sight of the vehicle passing other objects and a very shadowy outline of size and shape is left, together with a judgment based on the brightness of the light that the other car carried. Small size is normally associated with distance and similarly with dimness. Therefore a small dim light tends to be judged as farther away than it is. For this reason one may suddenly discover that an apparently distant car is actually one close at hand and coming at a fast clip, if it happens to be an ancient junk with small dim lights or perhaps a newer model running with cowl lights only.

There is also at times a possibility not only of mistakes in judging speed and distance, but even in recognizing an object or situation correctly. I saw a car last summer in which a driver had taken at high speed an opening into a field instead of the road. The car had rolled over several times and the driver, by a miracle, survived to go to a hospital. There have been probably many such accidents to drivers on unfamiliar roads which were fatal so that their cause

will never be known. Reduced speed on unknown and poorly marked territory is the only answer on the driver's part. The highway departments are showing commendable attention to this factor by supplementing warning lights with black and white checkering and diagrammatic signs.

Susceptibility to and Recovery from Glare

Glare has received quite a bit of attention from the engineering point of view and therefore has been widely recognized as a problem. For instance, windshields have been tilted to reduce glare from lights in the rear. There is also a physiological and psychological problem in glare. In general, glare leads to fatigue and also may cause accidents from temporary blindness. It can be shown in the laboratory that some people are able to see practically nothing when faced with a bright light, except what is illuminated by that same light. Others, on the other hand, are able to see a good deal more of the objects behind or beside the approaching light. In other words, there are wide individual differences in susceptibility to glare in apparently normal eyes.

There are also differences in the speed of recovery from glare. This is largely due to the speed of action of the muscle controlling the pupil of the eye. As everyone knows, the pupil contracts when a bright light falls on the eye; when the light is turned off or passes by, the muscle relaxes and the pupil again expands. In the contracted condition insufficient light enters the eye from dim objects for them to be seen, whereas after the pupil has dilated again a greater amount of light enters from these dim objects and they become visible. This effect is familiar to everyone in every day life, as illustrated by throwing a bright light on a screen covered window. When the screen is highly illuminated the pupil contracts and persons or objects behind the screen become invisible, although when the light is thrown off the screen, they may be quite plainly visible. Direct glare or glare on a windshield, either from approaching light or from light in the rear, has exactly this effect. It is known that the speed of the pupillary response varies among individuals and shows toward slowing with age.

Let us, to be conservative, say that drivers are effectively or partially glare blind for about a half of a second in passing another

car on the road at night, with the cars traveling at 50 to 60 miles an hour. This means that each car travels about 44 feet during this time. It has also been shown in several studies that it takes from 0.3 to 0.5 of a second to press the brake after seeing a signal; that is, a person's visual-brake reaction time is of this magnitude. Therefore between seeing a pedestrian and pressing the brake the car will travel from 26 to 44 feet, depending on the reaction speed of the individual concerned, and after that the time actually to stop the car must be added. It is therefore obvious that glare blindness and reaction time add something like 70 to 90 feet to the time shown by the engineers for actually bringing the car to a stop at 60 miles an hour after the brakes are applied.

The range of time of glare blindness, the degree of blindness of different individuals and the time for recovery of different individuals are being studied at present. One of the interesting features of giving tests of this sort is that although some individuals are aware that they are unusually glare blind and will say so, others are surprised to find that they cannot see objects as clearly around the oncoming light as do others, and yet they are passing cars just as fast as are the other drivers. The use of polarized light in automobile headlights, which has been recently suggested, seems to offer a possible solution for this difficulty in connection with automobile driving. It is possible that a similar system could also be applied in industry in situations where the worker is obliged to face the glare. The system suggested simply proposes that the light be treated by polarization so that each driver is sensitive mainly to his own light and therefore the glare of the oncoming light is greatly reduced. Objects illuminated by his own headlights in this fashion become brighter than those in the beam of the oncoming car and he has therefore good vision of the road ahead. Until such a system can be devised and made practicable, however, the only method of avoiding glare is to keep as much as possible of the oncoming light away from the pupil and the retina. The practice of watching the side of the road and the deflection of the approaching beam are methods of doing this. The unusually glare blind driver should be warned of his handicap and should cut speed on passing. And finally, the pedestrian public should be warned that the motorist often cannot see him even though he is

highly illuminated by the driver's own light. The same glare blindness also affects the pedestrian, of course.

Glare in industry has been shown to produce fatigue and to decrease output. Bright reflections from moving parts are one source of such glare. It has been found possible to increase output and decrease accidents by putting a dull finish on such bright surfaces. Other situations where glare occurs, of course, are in connection with the high temperature furnaces, arc welding, and even a clear glass window in a normally illuminated shop. Luckiesh estimates the average clear glass window in bright sunlight at ten times the intensity recommended for artificial illumination of interiors. Methods of eliminating glare in these situations have been worked out and must, of course, be fitted to the requirements of each industrial situation.

Fatigue from Bright Lights in the Periphery

It has also been shown that an unshaded light which in itself may not be especially intense but which is seen in the edge of the visual field rather than directly in front of the person, tends to cause a great deal of fatigue. This fatigue is much greater than if the same amount of light is thrown on a surface on which the person is working. The reflex turning of the eyes which is produced by a stimulus falling on the edge of the retina is apparently responsible for this fatigue. It will be remembered that this reflex was mentioned before in connection with the turning of the head in driving. In the industrial situation the worker may be forced to keep his head and eyes trained on the work which he is doing. At least this is usually the desirable situation. He therefore has a bright light at the periphery which tends to produce eye movements and possible head movements toward it and at the same time he must prevent these reflex movements and keep his vision centered on the work. Such a condition causes not only physical but probably nervous strain as well. It is therefore not surprising that increased output and a reduction in accidents have been obtained by shielding such bright points of light in the periphery of the visual field. A similar effect occurs in driving on a lighted street or road where, one after another, bright unshaded street lights travel across the periphery.

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Drowsiness and Sleep

It may seem a little far afield to discuss sleep. However, if we rule out ordinary physical fatigue, and physiological rhythms, the induction of sleep may become largely a visual problem and sleep is, in certain situations, an obvious cause of accidents. One of the experimental methods of inducing sleep in the laboratory is to turn on a fairly bright light a little above and in front of the person's eyes and to tell him to look continuously at it. If the individual is just left alone and follows directions, or if he is made to do a more or less monotonous task at the same time, drowsiness soon sets in.

One of the predominating factors involved here seems to be ocular fatigue. Glare produces fatigue, as we have just mentioned, and so do bright sources in the periphery of the field. Still another source of fatigue, which has been discussed again and again by the ophthalmologist and by the illuminating engineer, is eyestrain from under-illumination. This is especially important in work where reading or other fine work is involved, such as clerical work, needlework, and so on.

The psychological background of this effect is interesting and has been studied in detail in connection with reading. By photographing eye movements it has been shown that in reading, the eye jumps along the line from spot to spot, taking in two or three words at each jump. The actual seeing process occurs during stops, and if illumination is poor, longer stops are necessary. Furthermore, when the object is indistinct the eye tries to focus better and since it cannot, muscular tension and eye fatigue develop. Increasing illumination allows the person to see the material in shorter and shorter stops until he reaches the shortest stop that it is possible for the eye to make. Increasing the intensity therefore increases the speed of seeing up to a certain point. A further increase of intensity beyond that point does not increase the actual effective speed with which reading can be done and it begins to introduce the detrimental effects from glare.

All these visual factors which produce fatigue tend to bring on drowsiness. The worker or driver may not go entirely to sleep but may find himself unable to prevent fitful dozing. In this state bordering on sleep, the speed with which a person can respond to a

situation is very definitely reduced, as shown by reaction time measurements, and anyone who has driven with a person who is thus dozing knows how the car starts toward the ditch or toward the middle of the road from time to time. In case a culvert happens to be situated at the point where one of these swerves occurs, there is an accident and possibly fatalities.

The worker who is in this condition of sleep-borderland may allow a tool to slip, may not notice a warning signal, may forget to turn a valve. It is therefore highly important to eliminate these sleep-inducing visual factors.

Summary

In summary, the attempt has been made to point out the various factors which have been shown to be involved in reactions of the individual to visually perceived objects and signals, which are involved in visual judgments of speed and distance, and visual factors which are involved in fatigue and drowsiness. These factors thus in part determine the behavior of the driver or the industrial worker, and his liability to cause accidents to himself or others.

Studies on some of these factors, especially as they enter in highway safety, are now in progress at several universities but much remains to be done in respect to other factors. It is hoped that interest may have been aroused in research and preventive work along these lines.

Telescopic Spectacles

Willis S. Knighton, M.D.

A BRIEF description of spectacles designed on the principles of the telescope, which may be used upon prescription of the ophthalmologist by a limited number of visually handicapped who otherwise would function as blind people

THE telescope was discovered by Metius in 1608—over three hundred years ago—and from 1646 on many attempts have been made to correct poor vision by means of its magnifying principle.* A great deal has been accomplished in recent years, especially since the advent of the Zeiss spectacle in 1909, and remarkable results have been obtained in appropriate cases. Many patients have been taught to get around with greater facility while others have been enabled to read again. Where the vision has been brought back to economic usefulness, a seeming miracle has been performed.

Perhaps it would seem a simple matter to improve the vision by magnifying all objects, but many obstacles have to be overcome before the patient can wear such a spectacle with comfort and obtain any benefit. There are mechanical and optical difficulties of construction and design which need not concern us too much. But we must appreciate the fact that the patient is being introduced to an entirely new world of vision that is often confusing as the direct result of the limitations of this optical system. Unless he can learn to adapt himself, he will not be helped.

Telescopic spectacles must be light in weight, comfortable, and not too conspicuous. In addition, they must have a flat field of good size, practical magnification, and a minimum of optical errors, such as spherical and chromatic aberration, coma, astigmatism, curvature of field and distortion. Altogether, the designer

* The names and accomplishments of the pioneers will be found in medical treatises on the subject.

has very little degree of freedom, but by judicious manipulation of the optical composition, shape, and spacing of the lenses he is able to produce a thoroughly satisfactory magnifying system.

The Galilean telescopic system is best adapted to the use of spectacles. It consists of but two lenses, a converging lens on the object side, and a diverging lens on the eye side. Since the difference in their focal lengths determines the separation of these

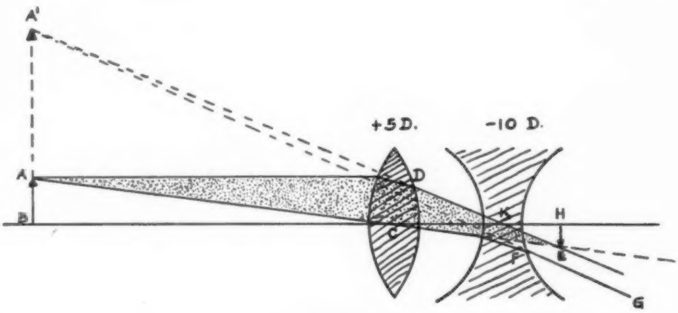


Figure 1

Rays from the object AB are converged by the first lens and then diverged by the second lens so that an enlarged erect image is formed at A'B. A ray from A going through C would continue unchanged to E if the diverging lens were not there. Another ray AD parallel to the axis would pass through K, the posterior focus, and meet the first ray at E, where an inverted image would be formed. When the diverging lens is placed at K, the ray DE is left unchanged (K is also the optical center of the diverging lens), but the ray ACE is diverted to G. The projections of the rays DE and FG meet at A' forming the final image A'B erect and magnified. The reader may form a simple telescope by holding a +5 D. sphere and a −10 D. sphere before the eye in the position indicated. The Eggers folding telescopic spectacles are made by using these lenses at a separation of about 9 cm.

lenses, the length of the telescopic spectacles is held at a minimum. The weight of the frame with lenses is about 30 grams, or slightly more than an ounce.

The field of view is of great importance. It must be large enough to give the patient a fairly good angle of vision for distance or for reading, and yet it must be kept within certain limits to avoid exaggeration of the optical defects incident to such a system. Unfortunately all of these defects increase directly with the amount of magnification used, and experience seems to show that from 1.3 x to 1.8 x is the most practical magnification for distance. In the Zeiss form of telescopic spectacle a field of 40 degrees is

obtained with a magnification of 1.3 x but in order to obtain a magnification of 1.8 x this field must be reduced to 24 degrees. In the Kollmorgen spectacles a relatively large field of 35 degrees is obtained with a magnification of 1.7 x but the correction of the optical aberrations is somewhat slighted, on the theory that patients with poor vision do not notice small deficiencies.*

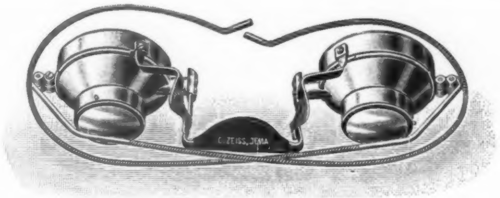
It will be noted that the enlarged image is formed *in the plane of the object.* (See Figure 1.) Theoretically the patient should see the image where the object is, but because of habit and association he invariably feels that the object is brought closer when the image is larger. Magnification causes the image to move faster than the object, and every turn of the head makes a fixed object appear to move in space. If the magnification is too great, it becomes difficult to hold the head steady enough for comfortable observation, and spatial relationships are confusing.

In close work the patient is confronted by still other problems. The same telescopic spectacle cannot be used for distance and for near vision; ordinary accommodation (ability to focus) will not suffice for near when the distance elements are before the eye. An additional converging lens must be used, either in conjunction with the eye-piece or in a mount to be slipped over the object lens. The latter is the more common procedure. Furthermore, if both eyes are being used, the axes of the two telescopes must be turned in to correspond to the converging of the eyes and the spectacles must be centered and tilted for the reading position.

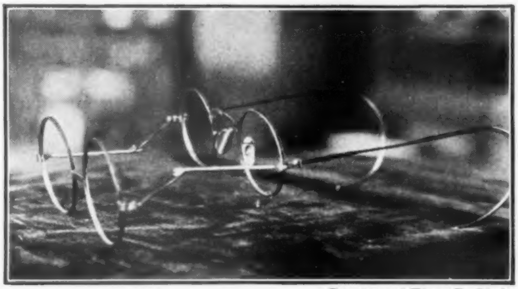
If the visual acuity is so low that a strong reading addition has to be made, close work is practically impossible with two eyes because of the magnitude of this converging angle. In this case the distance spectacles may be used if the reading attachment is placed over one of the telescopes and a dummy is used to cover the other.

The magnification for near is the same as that for distance when a 4 D. reading addition is used; it becomes greater with the increase in strength of the reading addition and may be as much as

* The Kollmorgen Optical Co. recently manufactured a telescopic spectacle with a magnification of 1.3 x in the vertical and 1.8 x in the horizontal. The idea was that the patient would get the benefit of the greater magnification in the horizontal but would refer all images back to the plane of the lesser magnification, thereby lessening the effect of nearness of objects and their apparent movement in space. This was the "wonder spectacle" that was exploited so avidly by the radio and press. It did not fulfil expectations and today even its designer is using it less and less frequently.



Zeiss Telescopic Spectacles



Courtesy of Theo. E. Ohrig

Egger's Telescopic Spectacles

Courtesy of Theo. E. Ohrig

Kollmorgen Telescopic Spectacles

4.5 x.* This is an advantage in that it may be the means of enabling the patient to read, but it introduces new limitations. As the strength of the reading addition is increased, the reading distance becomes shorter, the field of vision is narrowed, and the depth of focus is decreased. That means that the patient must hold his reading at a definite short distance from his eyes, he can see only a few words at a time, and if he moves his head the print will go out of focus. He may have to learn to read by holding his head perfectly still and moving the paper.

Before fitting telescopic spectacles it is absolutely essential that the patient's refractive error (myopia, hyperopia, or astigmatism) be fully corrected. Without this correction, the circles of diffusion created by the refractive error will be magnified and the patient

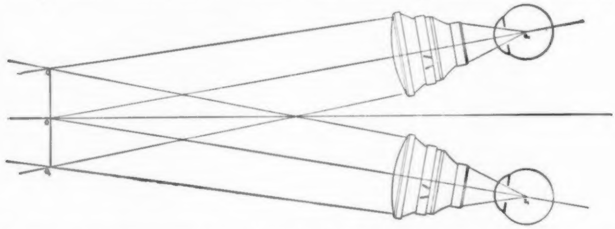


Figure 2.—Converged position of two telescopic units designed for binocular reading vision

might actually see better without the telescopic spectacles. Failure to observe this fundamental principle has caused many disappointments. The manner of adding this correction during the examination differs according to the make of telescopic spectacle used.

The necessity of centering the lenses for both distance and near cannot be emphasized too strongly. This is particularly true when binocular vision is attempted. The near lenses must also be tilted and converged, as mentioned before. Otherwise the patient will complain of color fringes, indistinct images and perhaps double vision due to the difficulty of fusing the images for the two eyes. Continual adjustment will be found necessary for comfort and for good vision.

* A microscopic lens has been devised which uses the microscopic rather than the telescopic principle. It may give as much as 25 x magnification, but it necessitates holding the reading so close as to be impractical except for the most deficient visual acuity.

The ophthalmologist has no way of telling beforehand whether telescopic spectacles will help the patient or not, except in the presence of pathology which has obviously vitiated the eye as an optical instrument. It therefore behooves him to see that all his patients with subnormal vision have an opportunity to discover whether it can be improved, unless his examination of the eye indicates that increased visual effort would be detrimental. The visual acuity is sometimes greatly increased, out of proportion to the magnification of the system. In these cases, it would seem that the enlarged image is made to fall upon retinal elements which have not been involved in the disease process.

It has been found that a patient with a vision of 20/400 or less can orient himself and get around the streets, but that he requires 20/40 for reading and writing. That would seem to indicate that a telescopic spectacle of 1.8 x magnification would not permit reading unless the patient had an initial corrected vision of about 20/60. Such is not the case, because of the extra magnification obtained with the higher reading additions, and the spectacles have been prescribed successfully for patients with a normally corrected vision as low as 20/200.

The success of telescopic spectacles depends upon many factors. Even after improvement in vision has been demonstrated, the patient may reject the idea of wearing them because of vanity or expense. If he does accept them, he must be made to realize the necessity of full co-operation with the ophthalmologist and with the optician. It is exceptional for a patient to feel comfortable and satisfied from the very first. Continual adjustments will be necessary and will require frequent visits to the optician. After the first exhilaration has worn off, patients complain that they cannot see so well, but if they are warned not to expect too much, and are carefully instructed in the way to use the lenses, they gradually improve. Often, when the vision is there, the patient must be educated again to appreciate it. If he persists he will learn to adapt himself to the new perspective.

The ophthalmologist must understand and sympathize. He can give great mental encouragement to many who think they are going blind. Indefatigable patience in testing, teaching and explaining will be well rewarded in the rehabilitation of the patient.

The Eye in Industry*

James H. Andrew, M.D., F.A.C.S.

FROM the point of view of safety in industry, it is not only important to provide safeguards, goggles, and adequate lighting, but eye inspection upon employment as well as periodically, in order that accidents may not be incurred through defective vision

IT may seem a truism to say that without eyes there could be no industry. It may seem equally absurd to state that without light the best eyes are useless. Yet upon these two facts depends the entire industrial fabric, and not that alone, but life itself.

As I see it, this subject of the eyes in industry may be well divided into three groups: First, in its relation to the employer; second, in its relation to the employee; third, in its medico-legal aspect.

The Employer's Responsibility

The great source of light is the sun. Man, in the process of evolution, adapted his eyes to the sunlight, and it became for human beings the most perfect illumination. During the ages, and keeping pace with his social, spiritual, and material uplift, man has utilized his ingenuity in producing artificial methods of illumination. With the changes produced by the advance of modern industrial civilization, many forms of light have been invented to take care of individual requirements. Crowding has taken place in great centers of industry so that our buildings have become ever higher and higher and closer together, shutting out the most perfect light, that of the sun, so that it has become neces-

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sary to replace it with light from other sources. This in itself has produced problems of which the aboriginal man never dreamed. Then again, modern civilized man uses his eyes constantly for work close to him, a condition for which the human eye is not perfectly adapted. So we are constantly forced to use our eyes in a way nature did not intend, under lighting conditions which are at best not perfect.

We know that fatigue is a common cause of disease, and fatigue of the eyes is a principal factor in many industrial accidents. It is a cause of much inefficiency in workers, from headache, loss of time, spoiling of materials, etc. Consequently, it is a source of direct monetary loss to both employer and employee. It is only comparatively recently that much attention has been paid to the conditions under which our eyes are to be used. Light may be so dim that objects can be seen only with difficulty, or it may be so strong that it exhausts the powers of the retina to a point where the eye is totally incapacitated. We try to reach a happy medium where our work can be well done with as little fatigue as possible. But, remember that we cannot judge by the brightness of the light alone, but by its effect on the individual while working at his particular task. We have instruments for measuring the amount of light, but in the last analysis the effect of the light on the individual is the final test. Some eyes require more light than others, particularly with advancing years, and some occupations require more light than others.

The pupil of the eye dilates or contracts automatically to allow just so much light to fall on the retina, but a sudden change from a bright light to a dim one, or vice versa, causes a marked failing of visual power for an appreciable time. The intensity of a light depends also on the luminosity of surrounding objects. The light of a match in a dark room may be positively painful; an automobile headlight at night is another common illustration of this fact. It is a mistake, therefore, to attempt work with a bright light shining in the eyes. Daylight reduces shadows to a minimum because it is so thoroughly diffused. Artificial light, because of its great intensity and poor diffusion, causes deep shadows; and these deep shadows are sometimes the cause of industrial accidents. If light falls directly into the eye, or is reflected into it

from a polished surface—a condition known as glare—the effect is the same. And glare is particularly bad when it strikes the eyes from below, as from polished desks, polished machinery, or water.

A factory, where land is cheap, built of one story with saw-tooth skylights facing the north, as you have sometimes seen, is almost ideal, as northern light is more uniform throughout the year and has a great volume but not a high intensity. Our modern illuminating engineers have done much to reduce the intensity of electric light and increase its diffusion, making conditions more nearly approximating a good north light. So if you contemplate putting up new office buildings or factories, or remodeling old ones, it is well to get advice about the lighting from a competent illuminating engineer.

Another contributing cause of suffering, loss of time, spoiling of material, compensation, etc., is faulty vision. How often do we employ workers, particularly those whose occupations are hazardous, without knowing the condition of their eyes? How much worry, suffering, and litigation could be avoided if we knew the condition of each worker's eyes before employing him? For example, you employ a color-blind chauffeur; he passes a red light not realizing that it is red, strikes another car or a pedestrian, causing a loss of life. Would not it have been better to have known about that color-blindness, and saved life and money by employing another man whose eyesight was good? Suppose you employ a mechanic to work on a complicated machine, and find out after much work has been ruined that the man sees well with only one eye as so many of us do, and has no depth perception. Would not it have been better to have known the condition of his eyes beforehand and saved money, material, and perhaps a ruined machine by giving him a job where fine distinctions were not necessary? In certain diseases the fields of vision are restricted; the patient can see only directly ahead but not to the sides. Such a condition is particularly hazardous because of danger to bystanders as well as to the individual himself. A comparatively few large industrial concerns do examine their applicants' eyes before they employ them, and then have them re-examined periodically, but I believe such concerns to be in the

minority. I fancy they find it cheaper to lock the barn before the horse is stolen. When I speak of examining the applicants' eyes, I do not mean a perfunctory examination for glasses by an eye-glass vendor but insist that such an examination should be made by a qualified physician whose training enables him to detect diseases of the eyes, in their incipiency. I should also advise that records be permanently kept of the condition of the eyes, noting every abnormality. I shall refer to this under the medico-legal aspect.

From the Point of View of the Employee

Now let us take the point of view of the employee. After the most careful examination and correction of his eyes, working in a shop where every precaution against accident is taken, we know that occasionally, in spite of fate, accidents do happen. They may be trivial or they may be serious. From a humanitarian point of view—to say nothing of the economic one—a faithful worker deserves the best care that we can give him. The majority of such accidents are fortunately trivial, and can be avoided by any one who will take the trouble to learn a little first aid. It is needless to say that serious accidents, or even those that are questionable, should be placed in the hands of physicians specially trained to care for the eyes.

The commonest form of injury is the ordinary speck of dirt, or emery, or whatnot that lodges on the eyeball or gets under the eyelid. These accidents may cause the most acute suffering, and by reason of infection carried with the foreign body, or by reason of germs getting into the abrasion that such substances cause, serious ulcers of the cornea may and do occur, with loss of the eye. There is usually some workman in every shop skilled in removal of such particles, using a sharply pointed knife, sharp nail, or some other object. Sometimes this knife or nail is carried in his hip pocket along with his chewing tobacco or dirty handkerchief. Needless to say, such instruments are never sterile and may cause infection in an eye which would be otherwise safe. Do not let Bill or Jack fool with these foreign bodies with his knife or nail. Such attempts should be followed by instant dismissal. A little piece of sterile cotton wound tightly on a toothpick will

usually remove specks easily—even the corner of a clean handkerchief will do. Turning over the upper eyelid to brush off particles adhering to its under side is easily learned, and everybody should know how to do it. If the particle does not come away easily, the patient should be put in expert hands.

All sorts of grinding and polishing processes are liable to cause eye injuries, usually of a superficial character. Bits of steel, emery, or polishing powders may get into the eye. These can be taken care of by removal as suggested before, washing, etc. It is always safe to put a drop of the ordinary 2 per cent mercurochrome solution in these eyes. This has the advantage of being found in many shops, is perfectly safe to use, and is a fair antiseptic. Its disadvantage is that it colors the skin red, but this stain is easily removed by water if done at once.

Explosions of gunpowder, dynamite, etc., may cause loss of one or both eyes or may cause the skin and conjunctiva (the membrane which covers the eyeballs and lines the lids) to be peppered with grains of powder. The grains of powder in the skin can often be helped by applying peroxide of hydrogen immediately. In the eyeball, they are best removed by an eye surgeon; if there is a delay, it is well to wash the eyes with a solution of boric acid, a teaspoonful to a glass of warm water. Cold applications applied over the closed lids, wet gauze or a wet clean handkerchief also help prevent inflammation.

Iron and steel workers show the largest percentage of industrial accidents, most of which may be prevented by wearing spectacles or goggles. The isinglass goggles are worthless because they are difficult to see through. Men working at chipping castings, turning on lathes, and grinding tools should always be protected by glasses, and the best glasses are the shatter-proof ones, although broken spectacle lenses almost never injure the eyes. The frames help hold the broken glass, and nature has provided natural defenses in the projection of the eyebrows, nose, and cheeks, as well as by the eyelids which automatically close so fast that they offer a great protection. Goggles purchased should conform to specifications of the National Safety Code.

It is very common to have chips of steel, sometimes only a millimeter or two in diameter, shot into the eyes with sufficient

force to penetrate the eye, lodging inside the ball or even going through the globe into the orbit. Sometimes these particles go through the iris, causing tears, and through the lens, causing cataract, or even injuring the retinal and choroid coats, causing serious hemorrhages. Sometimes the wound of entrance is so minute that it can be seen only with a strong magnification. If there is the slightest question, an X-ray should be taken. With our present means of localization, the exact position of the steel can be seen, and the particle can be extracted by means of the electro-magnet. If it is left in the eye, the steel rusts, causing a change of color in the eye and frequently rapid inflammation and breaking down of the tissues of the eye.

Particles of copper and brass less commonly are forced into the eyeballs because they are softer and not brittle and do not chip off so easily. Striking a cold chisel with a hammer has caused the greatest number of accidents that I have seen, pieces of the chisel or hammer breaking off and flying into the eye. Cheap hammers are usually responsible. The best hammers, thoroughly hardened, are the only ones safe to use. These particles go into the eye very hot and are not so likely to cause infection as are pieces of stone, mortar, or brick, which go in comparatively cold and carry infection for that reason.

We get many chemical injuries to the eye. Perhaps the commonest are alkali burns from slacking lime and plaster. Alkali burns are frequently worse than acid burns because the alkali continues to burn, whereas acid is soon diluted and neutralized by the tears. The first aid treatment of alkali burns such as those caused by ammonia, lye, lime, plaster, etc., is to put the victim on his back, open the eyelids, and pour warm water in large amounts into the eyes until expert help can be gotten. If you have vinegar handy, a few drops may be added to the water to help neutralize the acid.

Bottlers of aerated beverages are sometimes injured by broken glass, as are bartenders. X-ray pictures do not show glass unless it is lead glass, or rarely flint glass when the rays of light just catch the edge of the glass.

In any of these industrial accidents, frequently the object causing the injury has less to do with the destruction of sight than the

germs which may be in the eyes, or which are introduced by dirty implements used in its removal or by dirty dressings applied to the eyes. Small packages of sterilized gauze, large enough for one dressing, sealed in envelopes and not opened until they are placed on the eye, and a tube of sterile vaseline to be used but once, should be in every shop where eye accidents are likely to occur. These pads can be fastened in place with strips of adhesive plaster, or can be covered with a black fabric eye pad. Never, under any circumstances, use a celluloid eye shield, for because of its inflammable nature, it may cause serious burns through ignition by a carelessly lighted cigarette.

Importance of Medical Eye Examination

Before taking up the medico-legal aspect I would like to amplify the suggestion previously made of the importance of a complete eye examination by an eye surgeon, before employing any worker, from the point of view of efficiency, accident prevention, and consideration of disability other than accident, as well as the avoidance of demands on the pension fund of the organization. The reasons for this examination are: First, to prove that he is physically competent to do the work; second, that any pathological conditions which may be progressive, or which might be aggravated by minor injury or strain are not present, or if they are present, that they are a matter of record for consideration if their presence becomes a matter of importance in connection with a claim for compensation; and third, that the employee be given proper advice concerning any determinable tendency or inherent weakness so that he may take proper care of himself to avoid disability.

A complete examination of the eyes may easily be the most important part of a physical examination because it determines the employee's ability to see, which is likely to be a determining factor in his efficiency. Then again, such an examination may reveal conditions of the general health which are overlooked in an ordinary physical examination. For instance, unsuspected kidney disease, diabetes, brain tumor, syphilis, and tuberculosis are often picked up by the ophthalmologist without the aid of a general physical examination.

I would stress also the importance of regular and systematic eye examinations, for the reason that the eyes change with advancing years, and because a man has good eyes at the time of the original examination is no criterion of what he may have in the succeeding years.

Medico-legal Aspects of Eye Accidents in Industry

Under our present compensation laws when an employee receives any kind of injury, there are certain important considerations which may determine the cost to the employer. First, the kind of first aid treatment he receives immediately, and the competence of the treatment he receives subsequently; second, the extent of the damage done by the injury, which may easily be mitigated or even increased by the kind of treatment he has received; third, the aggravation of an existing pathological condition which may have been progressive in itself, and which might have caused blindness even without the injury. One constantly meets compensation cases where partial or total loss of vision is claimed, when, without a doubt, a pre-existing disease or scar from a previous injury has been taken advantage of to magnify the claims for compensation.

After the ophthalmological examination and the protection of the eyes by proper shatter-proof goggles, guards for machinery, etc., the next important consideration is the seeing conditions under which the employee works. The efficiency of a worker depends on the kind of illumination he receives. Accumulations of dirt on light bulbs and fixtures reduce the illumination and a little soap and water will remedy this trouble. So also dirty, drab surroundings absorb a proportion of light. Glare from unshielded drop cord bulbs within the range of vision, and from polished desks and machines, is easily taken care of, and its elimination adds to the workers' efficiency and decreases the accident hazard.

The medico-legal aspect of eye injuries is an absorbing and important subject which I shall have time only to touch upon but is one which comes very close to the hearts and pocketbooks of both employer and employee.

First, let us take up wounds of the eye, eyebrow, eyelids, etc.

They, like all other wounds, may be contused, incised, punctured, or lacerated.

Contused wounds of the external coverings of the eye are usually manifested by what is known as a black eye, ordinarily of slight importance, but occasionally sufficiently severe to injure the periosteum or membrane which covers the bone, where abscesses may ensue causing destruction of the eye. A contusion of the eye itself may cause rupture of the globe, cataract, dislocation of the lens, or detachment of the retina. It is important, therefore, to have a thorough ophthalmological examination of such cases immediately.

Incised wounds of the eyelids, brow, etc., are clean-cut and, in the absence of infection, heal readily without much scarring. However, if the edge of the lid is split, the tissues retract leaving a V-shaped deformity, unless skillfully sutured. The fibers of the levator muscle—that muscle which elevates the upper lid—may be severed, causing permanent drooping of the lid. If the two ends of the muscle are found and sutured, no such deformity takes place.

Incised wounds of the eyeball may affect only the membrane covering the eye in which case little damage is done; or they may injure the cornea or deeper structures which is a serious matter.

Punctured wounds are inflicted by slender objects: lead pencils, pens, sharp slender tools, etc. These wounds present two difficulties: First, the danger of breaking off a point of the instrument and its retention in the wound; second, the danger of infection—for we can safely consider that such wounds have carried into them ordinary germs of sepsis, and sometimes the germs of tetanus. The germs of tetanus develop in such wounds because of the exclusion of air. These wounds should be thoroughly cleaned down to the bottom, and injections of anti-tetanus vaccine given. If such a wound occurs in the globe itself, the patient should be hospitalized under expert care immediately.

Wounds of the cornea may be abrasions involving only the superficial layer, or they may be deep. The danger of even the superficial ones is that of infection and corneal ulcers.

Foreign bodies in the globe should receive intelligent first aid, then X-ray localization; and if magnetic, immediate extraction by

the electro-magnet, for the retention of a foreign body in the eye is a potential source of danger so long as it remains there.

Having done everything possible for the injured man and having perhaps saved his sight, have we gotten over all our troubles? By no means, for while I have the greatest admiration for the legal profession, there are black sheep in it, as in every other profession or business, and an accident case is like manna from heaven to some of them. They get in touch with the injured man and persuade him that his injuries should receive more compensation than he is getting, and if he happens to be the type of man who will yield to their persuasions, the employer faces litigation or increased compensation claims. This is done in three ways: First, by simulation or feigning of injury that had no existence in fact; second, by attributing to injury an actually existing disease or injury that had occurred previously, leaving some damage; third, by trying to exaggerate the amount of injury that did exist.

For instance, blindness of both eyes may be alleged. This is hard to get away with. A simple test is to close the eyes, extend one of the claimant's arms asking him to touch the tips of the fingers with the tips of the fingers of the other hand. If he is faking, he will not do this, but we know that the really blind have no trouble doing it. The eye specialist has other tests which he can make.

Blindness in one eye is easier to get away with. A simple test is to give him a book, or better, a page of numbers, place a pen or pencil vertically in front of the nose a few inches from the eyes. If he reads all the letters or numbers, he must be seeing with the allegedly blind eye because the pencil or pen shuts out some of the letters or numbers from each eye but allows the other eye to see them. There are numerous other tests.

A man may receive a blow from a fist cutting his eyebrow and try to attribute this to an injury in the shop. Such cuts are usually caused by the underlying bone, and because of that are longer underneath than on the surface. They are likely to have discolored edges, and the tissues are more or less ragged. A wound caused by a tool or instrument is longer on its outer surface than beneath and has sharply marked edges which are not so likely to be discolored.

There is a condition known as coloboma of the iris, showing a keyhole shaped pupil usually in the lower part of the iris, which is congenital and which is sometimes accompanied by blindness. Such condition has sometimes been falsely attributed to injury.

A condition known as pterygium, where the conjunctiva overgrows the cornea, is common in men who lead an outdoor life, sailors, truck drivers, etc. A similar condition sometimes occurs from injury, and occasionally a man with a natural pterygium will try to claim that it resulted from injury. A probe can be passed under a natural pterygium but not under a traumatic one.

A senile cataract or a diabetic one is sometimes palmed off as cataract resulting from injury.

I have recited just a few conditions that may arise in these compensation cases—though the list is limited only by the ingenuity of the claimant and his lawyer—in order to impress upon you the necessity of knowing, and having on record, the exact condition of the worker's eyes from the day of his employment, through the years, until his service is terminated. Such knowledge will save much money and many a headache.

Vocational Opportunities for Sight-Saving Class Students*

Charles E. O'Toole

THE author emphasizes the importance of considering the adaptability of the partially sighted to all occupations in relation to the various degrees of sight disability

IT IS the accepted philosophy of American education that every child should be given an opportunity for development according to his abilities. My work in education is in the field of guidance. Through guidance we help pupils discover their abilities and we assist them to development in line therewith. The factors in the guidance process are knowledge of the pupil's abilities, interests, ambitions and limitations, knowledge of the requirements and conditions in occupations, and true reasoning on the relation of these two types of knowledge.

The guidance program for the partially sighted pupils in our New York City schools is initiated through sight conservation classes. The teachers of these classes are concerned not only with the preparation of these pupils in the light of their abilities and limitations but with developing understanding of their eye conditions and the best eye habits and care essential to the correction and improvement of their sight. These pupils are motivated to choose and prepare for occupations through classes in occupational information and try-out courses in vocational subjects. They, also, are led to understand the abilities required for various kinds of work and how to relate these requirements to their own abilities and limitations, thereby definitely participating in the orientation

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and guidance process. They are not only taught to choose wisely the type of preparation for their future, but they are taught methods of self-guidance that will serve them well after they have passed beyond the school.

The basic principle of guidance is the recognition of individual differences. Since occupational skills are acquired and developed, it will be realized that many persons possessing the same degree of interest, ambition and even ability may differ in their acquisition of skill for the same kind of work. Ability and interest may open the door to employment, but success will depend equally upon the worker's development of skill in the work. There are certain basic skills; manual, mental and social, being the more generally recognized. The special consideration that enters in the case of the sight conservation pupil is his limitation to develop skill, based upon the degree of sight disability in each case. I contend, therefore, that we should not think in the terms of "what are the vocations for sight conservation pupils?" but, rather, in the terms of "how can sight conservation pupils adjust themselves to the vocations in which they are interested?"

Although I do not believe that we should be guided by so-called listed occupations for sight conservation pupils, I did consult a few such lists that were brought to my attention. I do not find it possible to learn from such lists the information that I seek regarding occupations for the partially sighted. In fact, I should not consider the vocational adjustment of the partially sighted on the basis of such a list. I shall read some of the occupations which I found listed: story teller in children's library, entertainer, teacher of dancing, teacher of elocution, interpreter in court, mother's helper, assistant in babies' nursery, ward assistant in hospital, practical nurse, manager of dog hospital, hairdresser, furniture polisher, housekeeper, waitress, laundress, cook, baker, kitchen maid, janitor, bookbinder, small store merchant, telegraph operator, wireless operator, automobile mechanic, gasoline service-station worker, garage worker, doorman, hat checker, elevator starter, sales clerk, collector, porter, bellboy, factory worker.

Since most of these are types of jobs held by adults it is quite obvious that they were listed from reports on persons who had secured employment. There is no reference in any of the lists I

have seen to necessary occupational requirements and preparation. Rather than think in the terms of "occupations suitable for the partially sighted," I prefer to think that an occupation should be considered non-suitable for the partially sighted only after it has been determined so from all the factors involved in occupational analysis as related to each degree of sight disability.

I have been engaged in placement work for the past fifteen years. It has long been the concept that placement of the handicapped should be conducted apart from the placement of normal persons. I find that there are handicaps more serious than the physical, such as the lack of proper attitude toward work and the personality handicap. Yet persons with such handicaps have not been singled out apart from others. In my opinion, it is this setting apart of the handicapped, intended, I know, to provide the best service, that actually militates against the best results in the case of the partially and less severely handicapped. Only a week ago I discovered an opening for a girl worker in a local concern. I have been interested in the placement of a girl who graduated with the highest honors from one of our high schools. She had been unplaced since graduation over two years ago. I told the employer about this girl's ability and accomplishments, also about her very pleasing personality. He said, "If she is all that you say, she is hired. Send her over in the morning." Promptly, at nine-thirty, the following day, when he expected to find me at my office, he telephoned me. "You didn't tell me this girl is lame," he said. "Of course, I didn't, because I do not see how her lameness will affect her work, and, after all, what are you hiring legs or brains?" was my reply. "I guess you are right, I'll hire her," he said. And that's my argument, my friends. Ability to do the work, all limitations considered, should be the basis on which placement should be made. During my experience, I have found many employers who willingly employed partially sighted persons but their sympathetic willingness was accompanied by their recognition of the ability of these persons to function as worthwhile workers at work for which they were capable. In fact, in the past, many large and small concerns preferred handicapped persons for certain kinds of work, particularly work of a repetitive nature, claiming that these persons were not only capable but were more attentive to their work.

Although the sight conservation pupil is entitled to every opportunity to prepare for the vocation of his choice, he cannot expect greater opportunities for absorption by industry than the average pupil. It has been stated that eighty per cent of the jobs in industry today do not require more than three weeks' training. In the light of this statement, the vast majority of these pupils, regardless of their vocational choice and preparation, may have to enter these jobs. In fact, if they were absorbed in proportion to the normal group, we should not be so concerned. In the interests of guidance, I feel that we should emphasize the importance of developing adaptability by these pupils to increase their opportunities for employment in this changing industrial world. The development of basic skills will promote this adaptability. For example, the pupil who learns how to operate a particular machine is not training for adaptability to the extent that a pupil does who trains for industry through a full apprenticeship in a machine shop.

True, the number of employment opportunities in general has decreased since 1929, but has the number of employment opportunities for the partially sighted decreased in proportion? What will be the absorption ratio of these persons in returning prosperity? How will changing occupational trends affect this group? These are but a few of the questions that should be answered before we can predict the vocational opportunities for our sight conservation pupils of today. Furthermore, without this knowledge of opportunities and trends, how can we guide our pupils wisely in their vocational choice and preparation? Don't for one moment think that our children are not giving some thought to this question. The fact that their fathers and older brothers and sisters, who may be educated and trained and who have no vision defects, have been unemployed for long periods of time is having its effect upon these pupils. Many of them have developed attitudes of discouragement that must be corrected before they will participate in a constructive guidance program.

Permit me to suggest three things that should be done in the interest of our sight conservation pupils. First, we should encourage these pupils to prepare for the new order in which they are living and which will offer them opportunities only in proportion to their development of adaptability; second, we should edu-

cate employers towards a consciousness of the ability of the partially sighted person as a worker and away from the mere expression of sympathy for such workers; and third, we should make a comprehensive study that will show the adaptability of the partially sighted to all occupations in relation to the various degrees of sight disability. This study not only will serve well in both guidance and education but in educating employers in our concept of the abilities of the partially sighted group as workers. If this is not done, we shall continue to prepare our pupils only to have them find that they may not be wanted when they are ready to enter the working world.

If you had expected that I would unfold to you a special field of vocational opportunities for these pupils in whom we are all so much interested, I regret to have disappointed you. All that I can offer you are the suggestions and I urge the agencies that are concerned with the vocational preparation and placement of these pupils to explore our vast continent of vocational opportunities. Perhaps a better understanding will be had and new placement concepts will grow out of such exploration, and we shall find it possible to render a better vocational and educational guidance service to our sight conservation pupils.

In conclusion, may I summarize the needs which should be recognized:

1. Adequate information as to the requirements of each occupation as related to the various degrees of sight disability.
2. Adequate information as to training requirements and training facilities for each occupation.
3. Adequate information as to occupational trends as they affect this group.
4. Adequate information as to facilities for placement of this group.
5. The promotion of employer co-operation in the training and placement of this group.
6. The promotion of local and state-wide clearance of all such information.

The accomplishment of this program of information and co-operation should make it possible for us to encourage these pupils to greater efforts with more assured success. Meanwhile, we shall attempt to train them in the development of adaptability so that they may enrich their possibilities for placement when they have passed beyond our schools.

Goggles*

Ralph W. Walder

A PLEA for the wider use of goggles in preventing accidents to the eyes in industry

IN almost every industrial center you can see a man going down the street with a cane. He is young and he looks healthy and strong, but he is tapping his way along, and when he comes to an intersection he has to wait until some passerby helps him across.

He is not using his cane to support a sprained ankle; he is blind—perhaps the victim of an industrial accident. His eyes can no longer thrill to the sunshine and the blue sky of a spring morning; he can no longer take part in his favorite pastime, whether it be baseball, fishing or hunting; he can no longer play cards at his club; nor can he watch his children run out to meet him when he comes home from work at night—in the first place he can't see them, and in the second place he probably has no job to come home from.

The eye is the most delicate external organ. It is a mass of nerves and muscles which transmit to our brain light and images; and while it is as well guarded by nature as it can be, nevertheless its position in the head is such that it is prone to mechanical injury.

Artificial eyes are made which fit well and are comparatively comfortable and comparatively inexpensive; it is hard for a stranger to distinguish an artificial from a natural eye. Artificial eyes will do, in fact, everything but see, and manufacturers will probably never be able to produce an artificial eye which will see. It is, therefore, most important to protect the workers' eyes, and this is accomplished by one or more of the following:

1. Proper guarding of machinery.
2. Proper guarding of the eyes.
3. Foresight in preventing eye injuries.

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There are several types of hazards against which protection is desirable and necessary. Perhaps the most common hazard is that incurred in chipping rust, scale or paint from old surfaces, breaking concrete and handling brick and old masonry. Another hazard which may not seem quite so dangerous, but which in fact is responsible for a large number of eye irritations, is ever present among those who work in dusty conditions as in foundries, in certain sand-blasting operations, and in handling cement and sulphur.

In machine shop work we have the hazards of direct blows resulting from flying pieces of steel and other machine parts, and the chances of any such flying metal entering the eye from the side are rather slight. Men are sometimes called upon to work in comparatively light concentrations of irritating gases, such as a light concentration of sulphur dioxide around refinery equipment or a faint trace of hydrogen sulphide as is often found on or near an oil derrick in a sour crude field. While complete respiratory protection is probably advisable in situations where such fumes occur, it is not always practical to provide or use such protection.

From this type of work it is only a slight jump to the many establishments which handle acids and other liquids either in the course of manufacture or in their employment in some other process —liquids which may splash and burn and which can do very sudden and serious damage to the eye.

In addition to the various sources of mechanical damage, we must give full and careful consideration to the possibilities of eye burns resulting from the many welding and cutting operations which now form such an important part of industry. The use of acetylene and electric welding and cutting equipment is becoming more and more prevalent. Unfortunately, a large number of people who are using equipment of this type are laboring under the impression that any colored glass which cuts down the glare and makes working conditions immediately comfortable provides a safe and adequate protection. This, of course, is far from the truth, as only certain types of glass are capable of absorbing the ultraviolet and infra-red rays which are not visible to the human eye.

There are available a number of different types of goggles, each designed to provide usable and practical protection for each of the types of hazards which are indicated. The one which comes first

to mind is the so-called chippers' goggles, and in modern form this is usually constructed of two plastic or composition eye cups made in rights and lefts, and anatomically shaped to fit the face. These cups or frames are well ventilated at the sides with either perforated metal or screen ventilators, and are held in place with elastic, gum rubber, or non-rubber headstraps. The lenses themselves are of shatter-proof glass, free from flaws or defects which would strain the eye. It is interesting to note that the manufacturers of standard goggles are able consistently to furnish lenses which have less optical error in them than may be expected to exist in even the most carefully made prescription lenses. Most lenses derive their shatter-proof qualities from a process of annealing which breaks up the natural strains in the glass and may be likened to the case hardening of metal. The natural elasticity of the glass is preserved in the inner part, but the outer portions are rendered hard to withstand the impact of flying objects, and the result is such that it will not fly into a great many pieces even if it is broken. Some glass used in modern goggles is flat or plate glass, whereas a number of manufacturers are now standardizing on optical glass with the slight curvature of 1.25 diopter. There are also on the market 6.00 diopter lenses which have a noticeable arch, and naturally derive extra strength from the arched construction.

The materials used in these goggles should be readily sterilized by boiling in water or by chemicals, and should be non-conductors of heat and electricity. The trend in chippers' goggles, as well as in many other goggles, is now toward the 50 mm. instead of the 45 mm. lenses which were used up until five years ago. In cases where men wear corrective glasses they have to be protected with chippers' goggles as well; for this purpose there are available several models of chippers' goggles with enlarged cups to accommodate the corrective glasses. What is basically a chippers' goggle can be used in a number of dusty conditions when the ventilators have been protected by suitable baffles on the inside assembly. The purpose of these baffles is to prevent dust from entering the cups, and, although the baffles cut down the ventilation to a slight degree, the additional protection which they give around particles of concrete, sulphur, emery, etc., is worth the comparatively slight discomfort due to the extra fogging of the lenses.

In machine-shop work, where the hazard is one of a direct blow, it is usually considered good practice to use a spectacle form of goggle rather than the cup type. The spectacle form of goggle is usually made of metal and glass throughout, although there may be a cushion on the nose bridge. The spectacle form provides ample protection against a direct blow while allowing full ventilation at the sides. These goggles are sometimes furnished with metal side screens, but it is difficult to obtain a metal side screen which is sturdy and which will fit the face comfortably. If the conditions are such that a spectacle with a side screen is considered at all, it is usually found to be a better practice to use the regular cup type of chippers' goggles. Shipyard workers and others employed in confined spaces where the ventilation is poor are usually provided with the spectacle type goggle, possibly on the theory that they would not wear the cup goggle, and 75 per cent of eye protection used all the time is better than 100 per cent used only when the boss is in sight.

The use of laminated lenses is to be discouraged because, although laminated lenses provide adequate protection against flying objects, they naturally tend to discolor in the course of time; and the resulting eyestrain may bring about a condition of discomfort which will result in the refusal of the workman to wear the protective devices. This discoloration is generally due to air and moisture getting between the sheets of glass and may be compared to the appearance of the early type of shatterproof glass automobile windshields after they were in service over a period of time.

For use in gassy conditions, we have the rubber gas-tight goggle which may or may not be furnished with shatterproof lenses. A goggle which is gas-tight is obviously air-tight, and the great difficulty with the older type of gas-tight goggle was that the lenses would fog up very rapidly. However, this feature has been corrected by the development of the "Nod and Shake" goggle, which has water wells in the bottom of the cups. A small amount, less than a teaspoon, of water is put in the water wells before the goggles are put on, and as the lenses fog up they can be readily cleared by the wearer who shakes his head, thereby throwing some of the water from the water wells against the inside of the lenses. The effect of this water is to wash off the fog and cool the lenses.

In handling acids and some other chemicals the conditions may be such that a rubber goggle with properly hooded ventilators will give adequate protection to the eye and still allow suitable ventilation. Such goggles are available from most manufacturers.

In welding and in cutting operations it is important to consider the possible effects of the invisible rays as well as the visible light. At one time, almost any colored glass which cut down the glare was considered to afford sufficient protection, and old-time welders who have become accustomed to a certain shade of glass are very much disinclined to change to an improved color. However, it is interesting to note that it is very often these old-time welders insisting on the same shade of glass which they used when they started to weld, who come to industrial hospitals with red and inflamed eyes. I quote here from Federal Specifications for welders' goggles: "The dominant hue shall be yellowish green unless otherwise specified." Various standard shades for welders' goggles were worked out by the United States Bureau of Standards and are available from all regular sources, and a person who is purchasing welding goggles for the first time would do well to seek and accept the advice of an experienced manufacturer who should, of course, be informed of the type of welding or cutting on which the goggles are to be used. In arc welding using 250 amperes or more, and in carbon arc welding and cutting, it is almost essential to use a head shield or hand shield which protects not only the eyes but the skin of the face.

Wherever goggles should be used we are quite apt to find opposition on the part of the workmen. This opposition may be primarily psychological and appears in two well-known and marked forms: First, the men say the goggles are uncomfortable; and second, they say they interfere with vision by limiting the side vision and fogging.

In putting over a successful eye-protection program, we may as well admit in the beginning that goggles are unnatural and something of a hindrance to work, but experience has enabled manufacturers to build goggles which are infinitely more comfortable and safer than goggles used two years ago. As indicated before, goggles are now anatomically shaped and made in rights and lefts. One reason why the goggles may cut a man's cheek is that the headband is too tight and worn incorrectly. If elastic headstraps are renewed

frequently or if rubber or non-elastic headstraps are used, there is no need to adjust them too tight—in fact, they should be worn so that two fingers can be passed between the head and the headband. Goggles should be worn sufficiently loosely so that there is no cutting of the cheek.

Fogging may be corrected to a considerable degree by the use of one of several anti-fogging compounds or pencils on the market. In many cases fogging is due primarily to perspiration, and by the use of a handkerchief or similar cloth tied around the forehead, this difficulty can be eliminated to a considerable degree.

Under ordinary circumstances a man uses a field of vision of about 150°. In most all these cup goggles 115° of vision is possible, and it is the general opinion that a man does not use a whole lot more than 115° of vision normally. When you want to see anything which is not directly in front of your eyes, you do not hold your head stationary and move your eyeballs, but you are more likely to move your whole head. Now you can do the same thing wearing a pair of cup goggles and get direct vision on your work. This fact has been demonstrated a large number of times in conversations with workmen, and usually the workman will agree that the cup type of goggle is not interfering with his practical vision.

In buying eye protection it is very much worth while to buy from reputable dealers and furnish goggles which meet federal specifications wherever there are such specifications applicable. By so doing the workman is assured of the best and safest protection, with slight chance that the lens will break easily or distort his vision; and the purchaser is assured of obtaining his money's worth, plus adequate service to take care of instructing his personnel in the use of goggles, and to take care of their repair as it may be necessary. Manufacturers should co-operate with industry in working out plans by which the use of goggles will be popularized among the personnel.

In conclusion, don't you think the saving of one, two or three eye injuries in a plant in the course of a year is certainly worth the earnest and careful attention of the management, both from the point of view of economical operation and freedom from compensation costs? It is obvious that to the employee figures will never represent the value of his sight to him or the distress and mental suffering to his loved ones!

Editorial

Eyes on Vacation

IS there anyone who does not have his eyes on vacation on a summer day? All roads seem to lead to the green fields and blossoming orchards. And the spectacle of open spaces and stretches of green does present the lure of rest to eyes, especially the eyes of city-bred people whose vistas usually extend no farther than the nearby skyscraper.

But summer, with its attractions of outdoor life, its increasing opportunities for sports, and its added hours of play, brings additional dangers to the eyes of old and young alike. In fact, frequently vacation days hold seasonal hazards for the eyes, such as high winds and bright, glaring sunlight. Children, enjoying their freedom from school, spend the greater part of the sunlit day out-of-doors, and, in the city streets particularly, their play is sometimes dangerous. There is the chance of being hit in the eye with a ball or with toys, or of infecting the eye through getting particles of dust or dirt in it.

Tennis, swimming and diving and other games and sports, present hazards to the eyes through accident. Occasionally we hear of cases of detachment of the retina caused by too violent exercise, and sometimes the black eye from a tennis ball may result in more serious damage to the eye.

Then, too, the popularity of the automobile has made it a more frequent source of accident. Especially over week-ends, increased numbers of automobile accidents are reported in the newspapers. In the past, not a few automobile accidents have resulted in the loss or serious wounding of an eye, because of shattered glass. Fortunately, recent campaigns for safe and sane driving as well as for the use of shatterproof glass in automobiles lead us to hope that there will be fewer accidents.

The common housefly is a source of infection and has been known to cause epidemics of eye trouble. In Egypt and some parts of the Orient, the fly is such a factor in the health of the countries

that during July, as the fly season advances, eye troubles increase by the thousands, so that an actual wave of eye disease occurs during July, subsides a little in August, and recurs in September, finally falling down as the later fly season wanes. Fortunately, the housefly has ceased to be a scourge in America, but still those sections which are most congested with people are inflicted with the most flies. It is necessary to observe the rules of cleanliness to keep flies from becoming a general health problem, and incidentally an eye hazard.

Perhaps the most serious eye hazard of all, during the summer months, is occasioned by the Nation's attempt to commemorate the most glorious of its holidays—the Fourth of July. Through force of custom this celebration has taken the form of shooting off fireworks, and young and old have preoccupied themselves with this form of celebration, to the great detriment of a percentage of them. Last year thirty persons are known to have died, and at least 7,738 were injured by fireworks, matches and bonfires. Through a thorough study of 3,000 cases in which it was possible to secure firsthand information, it was found that 2,500 required hospital treatment. The total number of eye injuries among the 3,000 cases was 539, and 57 persons lost the sight of one or both eyes. In the past thirty years alone, more Americans were killed in fireworks accidents than were killed in gaining our independence during the Revolutionary War. In the same length of time, there were sixteen times as many injured by fireworks than were injured during the Revolutionary War.

It is not the wish of the editors of the REVIEW to dampen the eager spirit of vacationists or to deprive the patriot of his right to express his zeal in celebrating Independence Day. All we wish to point out is that a lost eye cannot be replaced. It may make no difference so far as sight is concerned how it was lost, but it must make a vast difference to the victims to realize that they might still have their sight but for carelessness, neglect, or public apathy.

Lewis H. Carris, managing director of the National Society for the Prevention of Blindness, presenting the Leslie Dana Gold Medal to Dr. John M. Wheeler, director of the Eye Institute of the Columbia-Presbyterian Medical Center in New York, for his "outstanding achievements in prevention of blindness and the conservation of vision." The presentation was made at a dinner in St. Louis in honor of Dr. Wheeler.

Note and Comment

Society's Proceedings Available.—The *Proceedings* of the Annual Conference of the National Society for the Prevention of Blindness will be available on July 1. The 164-paged volume consists of sections on the following topics: Medical Social Service in Preventing Blindness; Prevention of Blindness Responsibilities of Official and Volunteer Agencies; The Problem of Fireworks Accidents; Annual Meeting Section; and The Public Health Nurse in Preventing Blindness. The volume is to be sold at cost—$1.00 per copy. Subscribers to the SIGHT-SAVING REVIEW will receive a copy, free of charge, as part of their subscription. Separate sections will be available at a cost of from 15 to 25 cents, dependent upon the number of pages of each section. These bulletins are listed in "Current Publications on Sight Conservation," p. 159 of this issue of the REVIEW. Orders may be directed to the National Society for the Prevention of Blindness, 50 West 50th Street, New York, N. Y.

Avoid Pitfalls in Eye Testing, Warns School Physician.—School eye tests should be indicative of the child's eye condition, not diagnostic, says Dr. Richard W. Weiser, medical supervisor of Kenmore, New York, in a recent issue of the *School Physicians' Bulletin.* All children showing visual acuity of 20/50 or worse in either eye should be rechecked for three successive weeks, since often a cold or other temporary health impairment causes a lessening of visual acuity. Since school testing cannot take the place of a thorough examination by an ophthalmologist, and is useful only as a screening device, it is open to errors. Every effort should be made to present the facts accurately to the parents so that warnings of eye trouble from school health authorities will be regarded as well founded.

Eye Medical Social Work at National Conference.—A joint meeting of the National Society for the Prevention of Blindness and the Family Welfare Association of America was held during the 63rd annual meeting of the National Conference of Social

Work in Atlantic City, New Jersey. The program concerned itself with "Responsibility for Interpretation of Eye Problems in Family Case Work," and the question was discussed from the viewpoint of the family case worker and from the viewpoint of a medical social service worker in an eye clinic. The Consultation Center afforded opportunity for delegates to confer with authorities in all fields of health and welfare activities, and medical social eye workers were met by representatives of the Committee of Medical Social Eye Workers at the exhibit booth of the National Society for the Prevention of Blindness. These included Mrs. Eleanor B. Merrill, of the National Society for the Prevention of Blindness; Miss Eleanor L. Hearon, eye social worker at the Colorado General Hospital; Miss Ruth B. McCoy, of the Department of Prevention of Blindness of the New York State Division for the Blind; Mrs. Francis W. Little, of the Maryland Society for the Prevention of Blindness; Miss Evelyn Carpenter, of the Philadelphia Committee for the Prevention of Blindness, Pennsylvania Association for the Blind; and Miss Jeanne Wertheimer, medical social eye worker at the Presbyterian Hospital, New York.

Eye Care for Children Popularized in Canada.—The Canadian National Institute for the Blind and the Canadian Welfare Council continue the joint publication of popular material on eye care for children. Two pamphlets recently received are "The Cross-Eyed or Squinting Child," and "Ophthalmia Neonatorum"; both are addressed to parents, and are forceful in calling attention to the dangers of neglect. Parental responsibility for getting treatment for both ophthalmia neonatorum and squint is stressed.

Eye Symposium at Biennial Nursing Convention.—To emphasize the trend of united efforts for adequate eye care, a symposium has been planned on eye health during the session of the Biennial Nursing Convention in Los Angeles, June 22 to 27. "General Eye Information for Nursing Students" will be presented by Miss Maria Johnson, R.N., superintendent for nurses at the Latter Day Saints Hospital, Salt Lake City, Utah; "Problems in Eye Health Confronting Public Health Nurses," by Miss Mary Emma Smith, R.N., state supervising nurse, State Bureau of Public Health, State Department of Public Welfare, Santa Fé, New

Mexico; "Saving Eyes in Industry," by Miss Lillian Jones, R.N., Fiber Board and Products Company, Los Angeles; "Scientific Advance in the Field of Eye Health," by Dr. John P. Lordan, Los Angeles; and "Ophthalmological Care and Why," by Dr. George N. Hosford, San Francisco. The meeting will be called under the leadership of the National Society for the Prevention of Blindness.

Eye Film for England.—"Do You See?" is the title of a new talking film made to illustrate the work of the National Ophthalmic Treatment Board in Great Britain. History of spectacles, the present-day need of eye care, and the relation of the eyes to the rest of the body and to general health lead up to a description of the services of the National Eye Service Center.

Lighting for Health.—Issued by the National Safety Council as its health practices pamphlet No. 18, "Lighting for Health" outlines the relation between lighting and eyestrain, and lighting and visual defects. This workmanlike bulletin refers to industrial studies that have shown the advance in health and efficiency through improved illumination; simple diagrams of light sources and visual mechanism make it of value as a popular and comprehensive reference.

Summer Courses for Sight-Saving Class Teachers.—Five universities will offer, during the coming summer sessions, courses for the training of sight-saving class teachers. The work offered is not only specifically directed toward the preparation of teachers and supervisors of sight-saving classes, but is of interest to those interested in sight conservation work. In order of the opening of the sessions, the courses will be given at:

University of Cincinnati, Cincinnati, Ohio.—June 22–July 28, 1936. Registration on or before June 15.

Wayne University, Detroit, Michigan.—June 22–July 31, 1936.

University of California at Los Angeles, West Los Angeles, California.—June 27–August 7, 1936. Registration, June 27.

State Normal School, Oswego, New York.—June 29–August 7, 1936. Registration, June 29. Course given at Syracuse, New York.

Teachers College, Columbia University, New York.—July 7–August 14, 1936. Registration must be made in person, July 2, 3 or 6.

Staff members of the National Society will serve as special lecturers at these courses. Complete information may be secured from the National Society's headquarters at 50 West 50th Street, New York, or from the universities giving the courses.

Lions Clubs Devote Special Program for Sight Conservation.—Definite and direct action for helping persons with poor vision and in assisting in conservation of vision has been taken by Lions Clubs in towns and cities all over the United States and Canada. Providing glasses to persons unable to pay for them, transporting people in need of eye care to hospitals, raising money for eye operations when otherwise it might be impossible for the operation to be done, instigating school eye clinics and special examinations, supplying funds for glasses for children with defective vision and for treatment in cases of eye disease, and organization work for the prevention of blindness are usual items in the reports of community Lions Clubs. The spirit of service that shares both time and money with those less fortunate has been marked in these efforts to conserve eyesight.

Aid for Color-Blind Drivers.—It has been estimated that from four to six per cent of the male population is color blind. Devices have been suggested to aid the driver of a car who is color blind, but the suggestions have usually been aimed at changes in the traffic signal design; Thomas Ross, of the University of Washington, describes an infallible and simple expedient for the color-blind person. By fixing to the windshield of the car red and green filters, one above the other, and not interchangeable, the color-blind person may carry with him his guide in interpreting the changing traffic lights. Because red and green are complementary colors, the red signal will be visible only through the red filter, and the green signal through the green. Further identification of the filters might be by perforation of the filters in such a way as to identify them by the design of the perforation.

Prevention of Blindness at Annual Meeting of the American Medical Association.—Three papers on subjects of popular interest were presented at the opening session of the section on ophthalmology of the annual meeting of the American Medical Association in Kansas City this year. "Causes of Blindness in Penn-

sylvania from the Medical and Social Aspects" was presented by Dr. Alfred Cowan. "The True Importance of Aniseikonia," by Dr. Edward Jackson, and "Cataracts Following Dinitrophenol Treatment for Obesity," by Dr. Warren D. Horner, were other topics having sociological as well as medical implications.

Safety Glass Becomes Standard.—When is safety glass safe? What qualities in a so-called safety glass are demanded to meet the description of safety? The American Standards Association has brought together certain requirements for safety glass, to which all safety glass must conform to insure protection in case of accident. Studies have shown that, to be considered safe, glass must withstand the impact of a half-pound steel ball, dropped from a height of ten feet; it must be so resistant to shattering that under no conditions will it break into fragments greater than 0.15 of an ounce. The problem of discoloration is taken into account in developing standards: exposure to ultra-violet light, equivalent to two and a half years of normal sunlight, should not produce more than an imperceptible tinge, unnoticed until the glass is placed on a white background. Tests for separation, resulting in distortion of images seen through the glass, include immersion of the sample glass in a saturated solution of sodium nitrate. Glass that passes satisfactorily through these tests will henceforth bear a label stating that it has conformed to the standards set by the American Standards Association.

Goggles Save Sight.—An employee of a large electric supply plant, attempting to drain water from a hydrogen drier, experienced some difficulty in opening the petcock. On the third attempt to release it, pressure from leakage in the valve suddenly forced out the plug, and splashed caustic solution over the employee's face and arms. Fortunately, goggles saved his eyes from the blinding acid, and a nearby water line prevented the serious burns that might have been the result had prompt washing not been possible. Routine safety practices—the compulsory wearing of goggles—saved a compensation loss of $15 a week for the rest of that man's life. Saving of that man's sight, alone, may have paid a large part of the cost of a safety program. Says *Safety Engineering*, in commenting on the incident: "Foreseeing possible

injuries and then guarding against them with safety precautions, instead of waiting until the accident happens, and then establishing safety procedure, is obviously much the wiser method."

Science Finds That Cat Has Two Kinds of Sight.—It has been an accepted fact that man needs three things for vision: eyes through which to see; light for illumination; and a brain to interpret the image that is seen. Yet experiment with cats, from whom that section of the brain cortex that controls vision had been removed, showed that they still saw light and that a sudden movement near their eyes caused blinking and other muscular reaction. Dr. Karl U. Smith, of Brown University, who reported this experiment to the American Psychological Association, concludes: "Apparently there is a critical division of labor between the nervous mechanisms controlling the eye movements alone and those controlling the body and legs in response to objects seen. In the normal cat, these mechanisms work together in perfect harmony and co-operation. But cats lacking entirely the visual cortex of the brain keep a rudimentary capacity to avoid objects and threatening gestures."

Color Rightly Woman's Tool.—Although in lower orders of creatures, color is the distinguishing mark of the male, among humans the male seems to be lacking in color sense, both physiologically and psychologically; color-blindness, present among four per cent of males, has been noted in less than half of one per cent of women. Among those not color blind, moreover, men find greater difficulty in distinguishing shades and tones of color than women, accounted for, perhaps, because as a rule women have greater interest and greater need for the application of color in their homes and in personal adornment. Unlike musical pitch, color is difficult to carry in the mind accurately. Because it is theoretically possible to detect two million colors, differing in saturation, brightness and hue, the eye cannot carry the close differentiations.

Prevention of Blindness in English Handbook.—The Standing Committee on the Prevention of Blindness of the Union of Counties Associations for the Blind has released a most comprehensive

Report on the Prevention of Blindness. Historical survey shows that the first movement for the prevention of blindness had its birth in London, in 1879, and inspired Fuchs, then a young professor, to write his memorable essay on "The Causes and Prevention of Blindness." From this early beginning has evolved the present organization for the prevention of blindness, whose program on prevention of blindness is clearly set forth in this publication. A section on the physiology of vision is followed by other phases of the eye in health and disease; Ascertainment and Treatment of Eye Conditions stresses the social and educational aspects of the problem of impaired vision; Occupational Blindness covers the problem of eye injuries in industry, and Suggestions for the Future outlines new paths to hew through preventable blindness. The book is a valuable contribution to the established literature on eye conditions and the sociological implications of preventing blindness. The material is clearly presented, comprehensible to the uninitiate, and suggestive to the worker in conservation of vision.

National Society Notes.—Staff members of the National Society will serve as special lecturers during the summer session training courses for teachers and supervisors of sight-saving classes. Mr. Lewis H. Carris, managing director, will lecture at the University of Cincinnati, Wayne University, Detroit, Michigan, the State Normal School, Oswego, New York, and Columbia University; Mrs. Winifred Hathaway, associate director, will direct the course given at Columbia University; and Mrs. Francia Baird Crocker, R.N., associate for nursing activities, will serve as special lecturer at the University of California at Los Angeles.

Assisting groups and organizations in promoting sight conservation in localities and as part of their program, staff members have traveled to various sections of the country. Mr. Carris talked with the Ohio State Organization of Sight-Saving Class Supervisors and Teachers on "Sight Saving as a National Responsibility." At New Brunswick's Week for Health, held under the auspices of Rutgers University, Mr. Carris talked on sight conservation and the prevention of blindness. In Lincoln, Nebraska, he assisted in a survey undertaken by the State Bureau of Child

Welfare, and in Philadelphia, he addressed the Philadelphia County Medical Society's section on ophthalmology. The presentation of the Leslie Dana Gold Medal was made by Mr. Carris in St. Louis. Here also he talked at the annual convention of the Edison Electric Institute on "National Responsibility for Sight Conservation."

Study of eye health problems in teachers colleges and universities has taken Dr. Anette M. Phelan, staff associate in education, to Smith College, Rochester University, Albany State Teachers College, State Teachers College at St. Cloud, Minnesota, and Ball State Teachers College, Muncie, Indiana; in co-operation with the Association for Childhood Education, she conducted a study class on "The Exceptional Child" at Columbia University.

At the Institute on the Conservation of Vision, held under the auspices of the Bureau of Prevention of Blindness of the Division of the Blind, New York State Department of Social Welfare, and sponsored by the Eyesight Conservation Committee of the Brooklyn Health Council, the Medical Society of Kings and Academy of Medicine, and the Brooklyn Ophthalmological Society, Mrs. Hathaway talked on "What are the Educational Facilities for the Visually Handicapped?" and Mrs. Crocker discussed another of the papers. Mrs. Crocker has been meeting public health nurses and student nurses on a trip which has taken her to Detroit, Michigan; Columbus, Ohio; Minneapolis, Minnesota; Madison, Wisconsin; Ann Arbor, Michigan; and to the Biennial Nursing Convention in Los Angeles, California. She represents the Society at that convention, with an exhibit, featuring a continuous showing of the Society's film, "Preventing Blindness and Saving Sight," as well as publications. The booth will be headquarters for visitors interested in the conservation of vision.

Mrs. Eleanor Brown Merrill, who represented the Society at the National Conference of Social Work and at the joint meeting of the National Society and the Family Welfare Association of America, talked before the National Council on the Physically Handicapped on "Occupational Adjustment of the Visually Handicapped," during its meeting at the Social Work Conference. Representing the Society also was Mr. David Resnick, director of publicity, who participated in the meetings concerned with social work publicity.

Radio programs have recently featured sight conservation: Mrs. Hathaway spoke over the air on "How's Your Eyesight"; a talk on "Conservation of Vision in School Children," was given by Mrs. Crocker; Miss Regina E. Schneider, secretary of the Society, talked on "How Sight Is Saved."

Current Articles of Interest

Enemies of Eyesight, J. M. Smith, *National Safety News,* January, 1936, published monthly by the National Safety Council, Chicago, Ill. Inadequate intensities of illumination, plus glare, place a serious burden on the eyes, says the writer, who points out the economic efficiency of good, planned illumination in industrial plants.

Trivial Eye Injuries, Sidney Walker, M.D., *Industrial Medicine,* January, 1936, published monthly by Industrial Medicine, Inc., Chicago, Ill. No eye injury is trivial, for the most unimportant accident may result in complete loss of vision unless proper care is taken. The author concludes: "It is very nearly an axiom that little credit is given to the industrial surgeon for the favorable outcome of an eye injury, and lots of grief if the outcome is not good. Therefore little is to be gained by unnecessarily exposing the injured man and yourself. For the protection of all concerned an early examination by a competent oculist should be had in many of the cases of so-called trivial injuries."

Hygienic Lighting Intensities, Miles A. Tinker, *Journal of Industrial Hygiene,* November, 1935, published monthly by the Williams and Wilkins Company, Baltimore, Md. "In general," summarizes the author, "it has been found that efficiency of performance is just as good at approximately 10 foot-candles as with brighter illuminations in such practical situations as letter sorting in post offices, doing number work and in reading. . . . There is no experimental evidence to support the suggestions that very bright lights are best for reading by normal eyes."

Squints and Squint Training, James H. Allen, M.D., *Public Health Nursing,* February, 1936, published monthly by the National Organization for Public Health Nursing, New York, N. Y. A physician describes for nurses the features of that group of squints which embraces the majority of cases and which offers good results from adequate early treatment. The stressing of this

knowledge to nurses, whose family contacts often make them the first to notice a case of squint in a young child, is of paramount importance.

The Case of Coryphee's Cousin. Chapter X of the *Doctor's Scotland Yard*, Robert A. Kilduffe, M.D., *Hygeia*, March, 1936, published monthly by the American Medical Association, Chicago, Ill. Fiction points to the hazards of dinitrophenol, a drug widely used for weight reduction, and to the chances of its use causing cataract formation in the eyes. In this story a dancer, seeking to reduce her weight, took a patent medicine containing dinitrophenol to hasten the process. The marked cloudiness of vision, which resulted from the drug, was incipient cataract. Reports have come of complete blindness, kidney and liver disturbances, and even death following the use of this drug.

Book Reviews

OPHTHALMIC NURSING. Maurice H. Whiting, O.B.E., M.B., F.R.C.S., London: J. and C. Churchill, Ltd., 1935, 184 p. ill.

Nurses will be interested to know about the second edition of this compact volume. It contains basic information for a better understanding of the function and care of the eyes with special emphasis on nursing procedures. Additional chapters on the anatomy and physiology of the eye written in the same concise and simple style would be valuable for nurses. After completing this book, one is not overwhelmed with the subject matter, but instead is eager to explore further in this special field. Its interest and usefulness could not be better attested. *Ophthalmic Nursing* is recommended to nurses wishing to secure a practical manual on this subject.

FRANCIA BAIRD CROCKER, R.N.

Briefer Comment

YEAR BOOK OF THE EYE, EAR, NOSE AND THROAT, 1935. E.V.L. Brown, M.D., Louis Bothman, M.D., George E. Shambaugh, M.D., Elmer Hagens, M.D., and George E. Shambaugh, Jr., M.D. Chicago: The Year Book Publishers, 1935, 638 p.

Drs. Brown and Bothman, whose contributions of abstracts of the year's contribution to progress in ophthalmology cover nearly 300 of the pages of this compact volume, have selected their material from a wide range of publications, largely foreign. The catholicity of the sources makes particularly valuable this reference work for those ophthalmologists and eye, ear, nose and throat specialists who do not have already access to comprehensive libraries of current publications.

THREE MONOGRAPHS ON COLOR. The Research Laboratories of the International Printing Ink Corporation. New York: The International Printing Ink Corporation and Subsidiary Companies, 1935. 3 monographs, 72 p. ill.

Selected as one of the fifty most attractively printed books of the year, this volume, consisting of three separate monographs,

is truly a treat to the eye for its beautiful typography and its colorful illustrations. Three topics are presented: "Color in Chemistry"; "Color in Light"; and "Color in Use."

MODERN OPHTHALMIC LENSES AND OPTICAL GLASS. Theo. E. Obrig, A.B. Philadelphia: The Chilton Company, 1935. 323 p. ill.

The author draws together a myriad of facts regarding the history of glass and its development as an optical aid; colored lenses; history of spectacles; contact lenses; telescopic spectacles; iseikonic lenses; bifocal lenses; and other varieties of glasses used to aid man to see. Of special interest to ophthalmologists, opticians and optometrists.

PROCEEDINGS OF THE NATIONAL CONFERENCE OF SOCIAL WORK. Sixty-second annual session, Montreal, 1935. Chicago: University of Chicago Press, 1935. 748 p.

As the 1936 annual session of the National Conference of Social Work draws near, it is opportune to review the published *Proceedings* of 1935, for its evaluation of the situation which was "only yesterday." The legislative changes which 1935 have brought in social planning follow in many instances the thinking expressed in the *Proceedings*, under child care, old age security and unemployment insurance.

MOTHER AND BABY CARE IN PICTURES. Louise Zabriskie, R.N. Philadelphia: J. B. Lippincott Company, 1935. 196 p. ill.

This profusely illustrated volume takes its place as a thoroughly modern presentation of prenatal as well as postnatal care for mother and child. The language is simple, the pictures graphic. Of particular interest to the readers of the SIGHT-SAVING REVIEW are the sections dealing with the care of the newborn baby's eyes as well as those mentioning the care of the eyes during the baby's sunbath.

Current Publications on Sight Conservation

Note.—The National Society for the Prevention of Blindness presents the most recent additions to its stock of publications. Except for the more expensive ones, single copies are sent free upon request. Unless otherwise specified, they are reprinted from *The Sight-Saving Review*. New publications will be announced quarterly.

197. Medical Social Service in Preventing Blindness. 56 p. 25 cts. Proceedings of the Medical Social Service Session, the Annual Conference of the National Society for the Prevention of Blindness, December, 1935.

198. The Problem of Fireworks Accidents. 32 p. 15 cts. Proceedings of the Fireworks Accident Session, Annual Conference of the National Society for the Prevention Blindness, December, 1935.

199. Influence of the Public Health Nurse in Preventing Blindness and Conserving Vision. 40 p. 25 cts. Proceedings of the Public Health Nursing Session, Annual Conference of the National Society for the Prevention of Blindness, December, 1935.

200. Prevention of Blindness Responsibilities of Official and Volunteer Agencies. 26 p. 15 cts. Proceedings of the Official and Volunteer Agencies Session, Annual Conference of the National Society for the Prevention of Blindness, December, 1935.

201. Glaucoma, Philip A. Halper, M.D. 12 p. 10 cts. An ophthalmologist's description of the course of glaucoma, its ultimate end, and what can be done about it to save sight.

202. Eye Conditions Prevalent in the Preschool Age, Charles A. Hargitt, M.D. 8 p. 5 cts. Malnutrition and poor environment in early childhood foster certain diseases of the eye.

203. Accidents in Traffic and Industry as Related to the Psychology of Vision, T. W. Forbes, Ph.D. 16 p. 10 cts. The author discusses the factors involved in visual judgments of speed and distance, as well as in fatigue and drowsiness.

204. Telescopic Spectacles, Willis S. Knighton, M.D. 8 p. ill. 5 cts. A brief description of spectacles designed on the principle of the telescope and their use.

205. The Eyes in Industry, James H. Andrew, M.D. 12 p. 10 cts. An eye safety program in industry should provide not only protection for the eyes against injury, but should provide for adequate illumination and inspection for visual defects, to prevent accidents from visual inefficiency.

206. Vocational Opportunities for Sight Conservation Pupils, Charles E. O'Toole. 8 p. 5 cts. The author emphasizes the importance of considering the adapta-

bility of the partially sighted to all occupations in relation to the various degrees of sight disability.

207. Goggles, Ralph W. Walder. 8 p. 5 cts. A plea for the wider use of goggles in preventing accidents to the eyes in industry.

208. Prevention of Blindness. Proceedings of the 1935 Annual Conference of the National Society for the Prevention of Blindness, 1936. 164 p. $1.00. Consists of publications 197, 198, 199, and 200, plus the papers presented at the annual meeting, namely: "A Greeting," by Helen Keller; "Scientific Advance and Welfare Programs in Sight Saving," by Father Schwitalla; and "Looking Forward," by Winifred Hathaway.

D88. Saving Eyesight in Industry, Rose Henderson. Reprinted from *Hygeia*, February, 1936. 4 p. 5 cts. Goggles are a sound investment in any occupation, says this article, and goggles for eye protection on different types of jobs are described.

D89. Shall I Continue to Use the Snellen Chart? Francia Baird Crocker, R.N. Reprinted from *Public Health Nursing*, May, 1936. 2 p. An evaluation of the screening of visual defects through the Snellen chart, and definition of its limitations.

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